The Research Quarterly

of the American Association for Health, Physical Education, and Recreation

Elmer D. Mitchell, Ph.D., Editor

VOLUME 13 — MAY, 1942 — NUMBER 2

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Published in March, May, October, and December by the American Association for Health, Physical Education, and Recreation, 1201 Sixteenth Street, N.W., Washington, D.C. Subscription, $3.00 per year; single copies, $1.00.

Send subscriptions to: 1201 Sixteenth Street, N.W., Washington, D.C.

Editorial and Advertising Office: 311 Maynard Street, Ann Arbor, Michigan. Advertising rates on application.

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Physical Education as a Profession

A Report by the COMMITTEE ON VOCATIONAL GUIDANCE
American Association for Health, Physical Education, and Recreation

THIS has been prepared as a preliminary statement concerning the total area of physical education, health and safety, and recreation, and is intended to be used by high school students, instructors in physical education, and guidance people. The report is published at this time in order to secure constructive criticism from a large number of individuals.

Special articles on each of the fields are in the process of preparation and will be published later. It is hoped eventually to develop four vocational pamphlets to sell in quantity lots at a very low price.

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INTRODUCTION

The important problem of selecting a profession is many times left to chance, or often postponed too far along in life. Fortunate indeed, is the young man or woman who makes this choice carefully, and early in life, surely not later than the senior year in high school. After the profession has been selected, the problem still remains of choosing the best and most efficient way of preparing for it.

It is with the purpose of helping you make the initial selection, and also to indicate some ways of preparing for a specific profession, that this article was developed.

CHOOSING YOUR LIFE'S WORK[1]

This is, naturally, the most difficult task of all, but here are a few suggestions which may be helpful:

1. *Examine Yourself*—Evaluate your traits and characteristics.
   A. Which of your school subjects have you enjoyed most?
   B. In what subjects have you earned your best grades?

[1] Adapted in part from F. J. Haskins, *The Importance of Choosing the Right Career* (Washington, D. C., publication No. 93214).

C. In what fields have you accomplished most?

D. Do you have any special talents or accomplishments?

E. How is your health? (Some professions are more exacting than others; all require good health.)

F. How persistent are you? (How hard will you work to achieve your goal? Are you easily discouraged? Can you meet obstacles, overcome them, and go on to new ones?)

2. *Study the Occupations of Society Today.*

A. Many old ones are disappearing.

B. Many are overcrowded.

C. Many new ones are developing. (Which ones offer the best future?)

D. Find out about those which interest you by visiting the library, or consulting a guidance specialist.

(1) Examine the *Dictionary of Occupational Titles.*

(2) Study the Occupational Information and Guidance Service of the U. S. Office of Education.

(3) Consult occupational studies of the National Youth Administration.

(4) Consult monthly bibliographies of the *Vocational Guide.*

(5) Read various vocational guidance books.

E. Talk with people engaged in the occupations which interest you. (This is one of the best methods *after* you have made your initial selections.)

(1) Study the qualifications demanded by employers in the areas which challenge you. (How do they compare with your own interests and abilities?)

(2) Learn about the hazards, the beginning salary, chances for advancement, permanency, contribution to society, opportunities, tenure, and pension plans. (You must look ahead!)

3. *Consider the Financial Outlay.*—You must seek answers to the following questions *after* you have made your selection, based on the previous discussion.

A. What does it cost to prepare for it?

B. How long does it take?

C. Does it require any special or unusual qualifications?

D. Where and how may one secure this education?

E. What is the future in the field?

F. Are you willing to make sacrifices to reach this goal?

4. *Seek Help in Arriving at a Conclusion.*

A. Discuss your interests, your tentative choice, and the answers to all preceding questions with

(1) Your parents.

(2) Your teachers.

(3) Your friends.

(4) Others who may be acquainted with you, your abilities, and the professions in question.

(5) Experts in the area considered.

B. Do not be too hasty in making your decision. Be open-minded and try to make an intelligent choice. *You may spend the rest of your life engaging in some aspect of the profession which you select!* Time well spent now may pay real dividends later!

PHYSICAL EDUCATION

You didn't realize there were so many things to consider in choosing a profession, did you? Now that you have some idea of the difficulties ahead, we shall assume that one of your present interests lies in the field of physical education. After studying the statements which follow, perhaps you may decide that physical education is the profession which interests you most. At any rate, try to keep in mind suggestions that have been made so far while you read on.

Physical education includes class instruction in the elective and required programs or in professional teacher-training courses, as well as the coaching or administration of athletics in the intramural and interscholastic areas. It may be either theory (lecture or discussion) or activity (engaging in sports and gymnastics) or a combination of these two. Related fields include health education, safety education, and recreation. Physical education, therefore, is a broad area of education, similar to the field of social studies in this respect, with many subdivisions.

WHAT ARE THE OPPORTUNITIES TODAY?

1. Included in Haskin's list[2] of the better careers today are "Athletic coaches, physical education teachers, playground directors, physiotherapists, and social service workers . . . "

2. Thirty-seven states, representing over 90 per cent of the population of the United States, have laws requiring the teaching of physical education in the public schools.

3. Thirty-two states, representing more than 80 per cent of the population have both laws and state programs.

4. Twenty-five states, with more than 75 per cent of the school enrollment, have state directors of physical education, actively engaged in promoting this field. These states include Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Missouri, New Jersey, Nebraska, Ohio, New York, Pennsylvania, South Carolina, Texas, Utah, Vermont, and Virginia.

5. Labor saving devices and improvements in machines have eliminated many heavy "back-breaking" tasks. The great majority

[2] F. J. Haskins, *Promising Careers* (Washington, D. C., publication No. 93274).

of employed persons are no longer too tired to enjoy their leisure, and many opportunities exist to help them use this time wisely. In normal times, much leisure is available to everyone.

6. The present national emergency has focused new attention on physical and emotional preparedness, with consequent improvement in the programs of teacher-training institutions, and trends toward broader, more comprehensive, and more vigorous programs in the public elementary and secondary schools. National and state legislation, as well as public opinion, are bringing this about.

7. While less than thirty thousand people are listed as being employed in this area, if part-time instructors (schools, summer camps, community recreation, and private institutions) are included, the number approaches one hundred thousand individuals, and this total is increasing.

8. Many more students are participating in physical education activities today than ever before. In 1922, less than 6 per cent of the secondary school population enrolled in such courses, but twelve years later, more than half of the high school population took part. Substantial increases have been made in this respect during the last eight years, and particularly since 1941.

This is a *live, growing* profession, with a real future for the right individual. You can help in making American health-, safety-, and sports-conscious, and assist in making its citizens physically and emotionally fit. Here are some of the opportunities for doing this.

TYPES OF POSITIONS

1. Almost every one of the 28,794 public and private high schools, representing more than 7,000,000 children, has a man coach who, in small and medium-sized schools, teaches academic subjects (mathematics, social science, and biological sciences are common) and physical education classes, and also coaches the school teams. Most of these schools have a teacher of girls' physical education, who in all but the larger schools also teaches one or more academic subjects (English, home economics, or biology are some of the most frequent combinations).

2. Many of the larger high schools (over 1000 enrollment) have special teachers of health and safety, as well as full-time coaches and teachers of physical education, both men and women.

3. Every junior high school has one or more special teachers of physical education, who frequently teach health and safety, and coach various sports.

4. Many school boards hire teachers for the elementary schools (usually women) who are qualified to teach health and physical education, as well as one or more grades.

5. Most private schools (especially military academies) emphasize athletic and interscholastic programs, in addition to broad rec-

reation, health, and physical education programs. Many excellent positions are found here.

6 Almost all large cities (over 50,000) have city directors of physical education, and many special teachers of health and safety, as well as supervisors in all three of these areas.

7. Many junior colleges, and most colleges and universities carry on broad programs of health, physical education, intramurals, and recreation for their students, taught or directed by qualified people.

8. All these institutions have intercollegiate athletics for outstanding men performers. This means unusual coaching opportunities for a small number of experienced individuals.

9. Many colleges and universities have teacher-training programs, one phase of which usually is the preparation of physical education and health teachers, coaches, and recreation leaders. Combining such teaching with other duties is a challenging opportunity.

10. Broad recreational programs are developing in many areas. Municipal (community centers and playgrounds), institutional (Y.M.C.A., Y.W.C.A., Y.M.H.A., Y.W.H.A., C.Y.O., state hospitals, penal institutions), and industrial areas offer many opportunities. Emphasis in the field of recreation, first aid, and health counselling is still in its infancy.

11. Religious groups are becoming interested in recreation. Many large churches have full-time leaders; most of them have either volunteer or part-time help.

12. Governmental agencies, particularly the armed forces (Army, Navy, Marines, Air Corps) are employing large numbers of trained persons for administrating broad, intensive programs of recreation and physical fitness. While the emphasis is tremendous during a crisis, it appears likely that the demand for instructors (men) of this type will continue beyond such a time.

13. The United Service Organizations (USO) is an adjunct to every Army and Air Corps camp in the country. Opportunities for well-trained men and women as directors and workers are many.

14. Movements such as the Boy and Girl Scouts, Camp Fire Girls, Friendly Indians, Boys' Clubs of America, American Youth Hostels, and others offer unusual opportunities for leadership in full-time and part-time positions, as well as summer positions.

15. Technicians in massage, exercise, and physiotherapy are employed in most large hospitals, athletic clubs, special schools for the handicapped and in state institutions.

16. Dieticians and social workers frequently receive their early training in some form of physical education.

17. The American Red Cross offers opportunities for qualified men and women in teaching first aid, water safety, and aquatics. While many of these positions are either part-time or volunteer, a number of excellent administrative and supervisory positions exist.

18. Summer camps are increasing in number and popularity. Over 100,000 persons served as counselors during the summer of 1933 in the United States. Students in physical education are usually given preference for such positions. Other opportunities are open to teachers and coaches. Many of these camps are directed by persons who are specialists in recreation, or in other areas related to physical education.

19. Summer playgrounds, sponsored by boards of education or municipalities, offer exceptional opportunities for employment during summer months, both during student days, and for years to come. In large communities, these activities are combined with park and field house programs into year-round positions.

20. Many personnel directors in industry and business, and a large number of principals and superintendents in the public schools, began their service in physical education, particularly in coaching.

There are surely many opportunities in this field for persons who are well qualified. Certain other important factors should be considered, particularly the advantages and the disadvantages of this profession.

ADVANTAGES

What are some reasons why physical education is a worth-while life's work?

Very few young people choose this profession as a career unless they have a real love for it and some special aptitude. If you believe wholeheartedly in what you plan to do, you nearly always accomplish a great deal more.

1. It is a wholesome profession that meets with social approval.

a. There are many opportunities for leadership, self-expression, and excellent contacts.

b. A satisfactory livelihood is possible for those who are well-equipped and successful.

c. One works mostly with young people, particularly in the schools. Many administrators consider the coach and the teacher of physical education invaluable in helping build right attitudes among young people. This is a challenging responsibility.

2. It is concerned with human beings.

a. One of the greatest satisfactions in life is watching and assisting in the development of young people.

3. It furnishes opportunity to keep health and vitality dominantly vigorous through activity.

4. Coaching and teaching in schools usually means three months of vacation during the summer, to rest, engage in other work, travel, or secure more education.

5. Promotions in rank and in salary are usually frequent for the good teacher.

6. Some states and many large cities have teacher tenure and provisions for retirement.

7. Many large systems have automatic salary increases after a probationary period.

8. Additional opportunities for broad community service are many (Scouting, church work, boys' or girls' club activities).

9. Extra money can often be earned if one is skilled in officiating various sports.

If you do not choose teaching or coaching, many other aspects of the whole field are open, as indicated in a previous listing of positions. Most of the statements just mentioned apply equally well to recreation, safety, and related fields.

1. Probably the greatest reward in recreation is the feeling of service.

a. There are great satisfactions derived from helping people spend their leisure time enjoyably and profitably.

2. The physiotherapist, the dietician, and the health expert make direct contributions to the health of individuals.

a. Bodies, as well as entire lives, can often be modified and changed.

3. The person who conducts his own exercise establishment, including many of the activities previously discussed, has the additional satisfaction of being his own boss.

In any case, physical education and its related fields open up new sources for increased happiness and the satisfaction that comes with the knowledge that you are teaching and supervising skills which enrich living and develop and mold the lives of human beings. This is an old profession which is receiving new and tremendous emphasis. Development has just begun. The present demand for trained leadership exceeds the supply.

DISADVANTAGES

It is always wise to consider any possible drawbacks to the profession which you are considering as a life work. There are many reasons why you may not like physical education. It is possible that you may not be prepared to make the sacrifices and meet the heavy demands which such a profession will impose on you.

1. Physical education is an active profession.

a. It demands long hours and much energy.

b. There is little or no leisure during the school year, except during short vacations.

c. If your health fails, it is difficult to keep your position.

d. You are expected to lead, direct, and engage in many more school and community activities than anyone else in the school system.

e. As a person grows older, he must plan to move up into ad-

ministrative work, provided he has shown progress and initiative. This takes special ability and unusual success.

f. A person is often so busy teaching others to play that he has no time for his own recreation.

2. Coaching is a highly hazardous profession.

a. Coaches are frequently dismissed because their teams fail to win the games expected of them. Although winning depends on the material available, as well as the strength of the opposing team, the coach receives the blame and criticism.

b. Coaching sports is difficult at all times, but particularly so when it is in addition to full-time teaching in academic subjects (usually the case in small and medium-sized schools) and physical education classes. It is only in large universities that an individual is occasionally hired to coach just one sport.

c. Age is a tremendous factor. Often, as you grow old, your position may be turned over to a young coach with "modern" ideas, and you may be discharged, or given a less responsible position.

d. Coaching carries with it a tremendous emotional strain, brought on by the uncertainties of the profession, and the great and unusual nervous and physical energy it demands. Very few coaches continue in this profession after reaching middle age.

e. The public is fickle and often unjustly critical of a coach, even one who is successful.

3. Most positions in physical education and coaching which are open to beginners are in small schools (seventy-five to one hundred students). It is only when a graduate has been a very successful athlete that he may possibly secure a position in a large school. His responsibilities are correspondingly greater.

a. In 1938, 17 per cent of all high schools had an enrollment of 100 or less; 34 per cent, 200 or less; 48 per cent, 300 or less; and 62 per cent, 500 or less.

4. Most teaching positions carry with them the added responsibility of participation in community activities such as church work, Boy and Girl Scouts, and other groups.

5. Almost all the positions in this area require considerable preparation and ability in the teaching of academic subjects in one or more fields. The smaller the school, the more classes in different areas are usually taught by one instructor. Daily preparation, lesson plans, and grading papers sometimes occupy much time.

6. Continued study, building up minors (for teaching the academic subjects) and graduate study (at least a master's degree) through extension courses, and summer school attendance is usually a requirement for promotions in all school systems.

7. Attendance at conventions and institutes, and subscriptions and contributions to professional publications and community projects are almost mandatory.

8. Too often a person's success and his chances for advancement depend directly on his ability to write, and his success in publishing articles, syllabi, and books. Time is not provided for this in school.

9. Those who advance in the profession are usually the ones who conduct surveys, carry on studies, and engage in various other aspects of technical research. This must nearly always be done in addition to, and outside of, regular duties.

10. A coach or instructor is expected to officiate at contests of all kinds. This is often most difficult, and may create additional nervous and physical strain.

11. A coach is frequently expected to be available as a banquet or program speaker on a variety of subjects, for both the community and the surrounding territory. While this can be a challenge, it often becomes a most difficult task, particularly when it is in addition to the heavy coaching and teaching load. Many such demands must be met.

Most of the disadvantages already mentioned can be applied directly to all related fields. It may be helpful, however, to consider a few which concern specific areas.

1. The majority of recreation positions require attendance "on the job" from noon to ten or eleven o'clock at night, with work on holidays and week ends.

a) Everyone plays but the recreation worker.

b) Little, if any, free time is yours.

2. Camp and playground positions usually offer only temporary, summer employment.

3. Many workers in industry are both suspicious and resentful of the attempts of leaders to advise, assist, or direct their recreation.

4. An instructor must be versatile and have outstanding ability in many areas, except perhaps in a few large systems.

5. Politics play an all important part in the securing and the holding of many of these positions.

Physical education and its related fields, is *not* a lazy man's job! Every position requires hard work and concentrated effort, with countless obstacles to overcome in order to be successful.

Now that we have a balance sheet drawn up, and have considered not only the opportunities, but weighed the advantages and disadvantages, let us study certain other important factors.

SALARIES

One of the first things that interests a young person when considering a vocation is always, "How much does it pay?" "How much can I earn?" Many studies have been made of this subject, and while beginning and top salaries vary greatly with experience, with sections of the country, and with the size of community and school or institution, a few facts may be helpful.

This area offers you an adequate income, comparable to other subjects (especially in coaching). Beginning salaries are sometimes not as high as in certain other professions, but the expense of preparation is often lower. In medicine, for example, an individual spends four years in "pre-med" courses at a university, four years in medical school, and one or two years as an interne. The length and cost of preparation is not quite as long in law, but it usually takes five or six years. It must be remembered, however, that in these and similar professions, where we find a person with experience earning $5,000 or more, there are many others who earn considerably less. Some do not make a living wage during the first two or three years of practice.

Salaries range from approximately $1,000 to $1,800 for beginners in the middle west (slightly higher in the far east and far west, and lower in many of the southern sections) to from $2,000 to $15,000 for experienced people. There is considerable fluctuation in salaries paid inexperienced people during periods of national prosperity or depression. Only a few "big-time" coaches, and some heads of large park and recreational systems receive the largest amount listed. State and city directors (all experienced people with years of experience) receive from $2,500 to $12,000.

Most recreation positions pay from $1,200 to $10,000. In large cities, there are also many part-time positions in institutions such as the Y.M.C.A., Y.W.C.A., and particularly community centers. An individual may frequently secure such a position and continue his undergraduate or graduate education at the same time. This may pay from $50 to $80 a month. Summer camps jobs usually pay from $50 to $100, and expenses for the season, but may be augmented by securing campers. Persons in athletic clubs, physiotherapy, and similar positions receive remuneration proportionate to their training and experience. Some of these individuals have had little formal training in their field. There are frequent opportunities here for extra remuneration through private instruction or individual treatment.

Most individuals add to their income by officiating at athletic contests, by writing books and articles, and by assisting with municipal or playground recreation during the summer months. Some coaches design sports equipment while a few are on the staffs of sporting goods companies as consultants. Only a few of the most successful coaches ever reach this status, however.

The person who is well-trained, who adds to his training by continual study, and who is successful, can look forward to almost certain increases in salary until he reaches the peak set for that particular system or organization, after ten or fifteen years of experience. This naturally varies with locality, and often is speeded up through promotions from one system or to another institution.

Few individuals in this area ever become wealthy, but the great majority make a satisfactory livelihood. The remuneration received must not be considered merely in terms of money, but in the health, satisfaction, and social approval which accompany such positions.

We have considered the many varied types of positions in this area, the advantages and disadvantages of the profession, and the approximate salaries. Let us now go back once more, to the most important factor in choosing a profession, the one person concerned, *you*. In the following outline, ask yourself definite questions based on each statement listed. Unless you can answer the great majority of them in the affirmative, it may be wise to seek additional evidence before selecting physical education as your life's work.

QUALIFICATIONS

This is a most strenuous profession and should attract only individuals who are well above average in many traits and characteristics. It is one of the service professions, and aims to enrich the lives of people.

1. Health. You must have good physical health, and vigorous, robust health is essential for success. Emotional balance, which presupposes good mental health, is just as important.

2. Intelligence. Unless you have an intelligence quotient of at least 100, it is doubtful if you should give serious thought to this profession. Just as much ability is required to complete the educational program and later to become successful as in any other field.

3. Voice. Since most of your teaching is carried on by talking, it is essential that you possess a clear, pleasant voice. Besides, you will be expected to make many speeches "on the job."

4. English. Contact with all students in school, as well as many public appearances, makes mastery of the English language an essential. It is necessary that you express yourself clearly, forcefully, and without grammatical errors.

5. Physique. Appearance which seems to indicate good health, is most important. Good posture is a related asset. The individual who is below average in stature, and particularly the obese person will not be accepted at some teacher-training institutions.

6. Skills. Many skills can be acquired during the teacher-training period in college or university, but the individual who already possesses some of these basic skills has a decided advantage. Time alone prevents mastery of all of them during this period, unless the individual had some ability and skill prior to entering this profession.

7. Athletic Ability.

A. A fair degree of proficiency in several sports, and high school letters or their equivalent, usually indicate that you will get along well with the activity or skill part of the teacher-training program.

B. Earning a letter in college, or being a member of a varsity squad is most helpful in securing a beginning coaching position.

C. Certain fields, such as health, safety, and the conduct of some aspects of the recreational program, i.e., crafts and hobbies, do not require much, if any special athletic ability, although skill as expressed in graceful and efficient body movement is always desirable.

8. Physical Defects. Defects such as stuttering, deformities, physical impediments, and general appearance, including obesity, disqualify a person for many types of positions, particularly in teaching and in recreation where one comes in contact with children and young people. Such persons can often make significant contributions in research, in arts and crafts, and in other relatively specialized areas.

9. Character and Personality. Likeableness, moral strength, and social adaptability are factors largely responsible for success or failure.

10. Interest in People. Since most of the activities engaged in by instructors in physical education are concerned with people, you must be interested in them as human beings, understand them, and possess superior social ability in order to get along well with them.

11. Desire to Teach, Coach, or Direct Recreation. Much more than just interest or ability in one or more activities or skills is included. You must want to teach or lead in this field in preference to and above all else.

12. Ability to Teach. This implies qualities of leadership, and is something you cannot be sure of until you actually experience it. If you are successful in leading groups, and particularly if you enjoy doing this, it may be a hopeful sign. This often indicates that you may become a good teacher, if you possess many of the qualities already mentioned, and are willing to work hard to secure the necessary preparation.

13. Ability to Organize. This factor is closely related to personality and disposition, and probably includes many others. Alone, you can accomplish a little. Through good organization, applying efficiency of methods, full use of facilities, and securing cooperation of students and faculty, you can usually accomplish a great deal more.

Qualities such as patience, sincerity, tolerance, loyalty, cooperation, reliability, professional interest, sympathy, good temperament, tact, and a willingness to work and sacrifice are also very important.

You have just read over quite an imposing list of characteristics and qualifications. Perhaps you had never given many of them much thought before, but all of them are important, in varying degrees, when considering the choice of profession, and of specific value when considering physical education as a life's work.

"Each is given a bag of tools...
A carving block and a book of rules.
Each must make 'ere life be done
A stumbling block or a stepping stone."

Your tools are your skills and knowledge, your carving stone the positions for which you are prepared, your book of rules the requirements and regulations to qualify you for this work.

Many of the qualifications just brought to your attention can be strengthened and improved by conscientious and continuous effort. Read a book such as Dale Carnegie's *How to Win Friends and Influence People* for specific suggestions on how to make the most of yourself, and then try some of them. You will be surprised!

BACKGROUND

Again, *you,* as the individual chiefly responsible for your own success or failure, must be the most important consideration. It is helpful in entering any field, and particularly in making a success of it, if you keep this in mind. In addition to participation in a wide variety of activities, and evidence of some athletic ability in high school, a background and interest in the biological sciences and social sciences are valuable. A good foundation in chemistry, hygiene, and nutrition, as these relate to health, is also desirable.

Interest and ability in various hobbies and recreational activities such as arts, crafts, and nature are worth while. Special talents in any area, particularly in music, art, and drama, are of great value, especially in recreation.

There are always individuals who do well in their teacher-training course without all the experience indicated by the preceding section, but if you *have* such a background, your chances of success are only hindered by the number of undesirable characteristics that you may possess. In other words, good personality and character qualities in addition to worthwhile experience in a wide variety of activities make your certainty of success much greater than would otherwise be the case.

COURSES

When you realize that preparation in this field requires four years of study at college or university, you can understand how difficult it would be to list the courses or subjects which you would take. This is complicated still more by the fact that the courses vary with the school you select, and even more so with the fields of specialization in academic subjects which you choose. These might include such areas as biological sciences, social sciences, mathematics, or others.

Many of the courses already mentioned are either background or fundamental courses, or part of the two minor subjects that most graduates secure. From your point of view, courses in physical education and the related fields will probably be most interesting. Both theory and practice courses will challenge and stimulate you. There always is a great deal of emphasis on acquiring some skill in and much knowledge of the principles and teaching methods in a wide variety of sports.

Courses in anatomy and physiology, kinesiology (the study and function of movement), as well as courses in recreation leadership, camp leadership, corrective and remedial programs for the physically handicapped furnish additional challenge. Principles of organization and administration, supervision, curriculum building, testing, and related subjects may also be included. Courses in safety, the school health program, methods of teaching health, and experience in student teaching will round out your professional education.

In some institutions the student pursues a general, or foundation course the first two years, with most of the specialization in physical education during the last two years. In others, the student begins with some specialization the first semester. Occasionally, programs are so arranged that after a general two-year course with some specialization, the student may elect to specialize in some area more intensely, such as dance, coaching, recreation, physical education, or health and safety, at the same time that requirements for two academic minors are being completed. Some persons major in other areas than those discussed here, and secure only a teaching minor in physical education or health. These individuals take courses in physical education and related fields, but instead of securing thirty to fifty hours credit there, usually earn only sixteen to twenty hours. They are nearly always better prepared in their academic subjects.

One of the best ways to learn something about the preparation required in the profession of your choice is to secure a catalog or course of study from several institutions, and then study and compare the offerings and the requirements. Here again it is most advisable to ask parents, friends, teachers, and particularly those individuals who are already actively engaged in the field, to help you understand, select, and finally plan your future. This brings us to the last point to be considered, namely the question of selecting the school where you may secure the best preparation to become a coach of sports, a teacher of physical education, health, or safety, or a recreation leader. If you have used good judgment up to this point in deciding on a profession, be sure to continue, and *select your school as carefully as you choose your career.*

COLLEGES AND UNIVERSITIES

Since the organization of the first four-year course preparing teachers of physical education a little more than twenty years ago, there has been a great increase in this and related areas. Today, more than two hundred institutions, public and private, colleges and universities, normal schools and municipal groups offer a variety of such training leading to a number of different degrees. It must be obvious that completeness of the training, the success of the graduates, and particularly the recognition of the particular institution vary just as much in physical education as in other fields.

You can secure a list of institutions offering training in your chosen profession at most any library. It will not be possible, of course, to mention any specific institution here. Private schools usually charge a higher tuition than public schools, and normal schools ordinarily cost less to attend than most of the others. The first suggestion would be to investigate the offerings of your own state university. Do they have a strong department of health and physical education? Do they offer a good major which is recognized as such by educators? Are the graduates quite uniformly successful?

The emphasis on a field often varies with the school. One is noted for its courses in testing, another one for a course in dance, this one for its program of safety, and still another for its outstanding contribution to the training of recreational leaders. You see, then, that your choice of a profession, and particularly your interest in a certain area, should determine your final selection.

If you have read all the material which precedes this and still believe that you are interested in a career in this profession to the extent that you are interested in and willing to participate in a broad, challenging, but most intensive four-year training program, with social service and human welfare the goal, then by all means let nothing deter you. Our profession needs future leaders who are willing to make all sacrifices for the ideal of a strong, physically and emotionally prepared America. If you enroll, you have accepted a challenge in this profession. Your future is in your own hands! Good luck!

SUGGESTED REFERENCES

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The Relation of "Quickness of Bodily Movement" to Success in Athletics

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THE PROBLEM

THE main problem of this investigation was to determine the nature of the relationship between "quickness of bodily movement" and success in athletics. It involved the adaptation and development of suitable instruments with which to measure "quickness of bodily movement" and the determination of the relationship of the obtained measurements to successful participation in athletic activities.

For years coaches of athletic sports and teachers of physical education have been attempting to analyze and measure the various factors that contribute to success in athletics. Tests that tend to single out and measure the amount of contribution of such factors as strength, endurance, skill, agility, and speed of running to athletic ability have been developed and used for some time. Quickness, or the ability of the body to overcome the effect of inertia, has, however, never been included as a separate measurement in any of these tests.

The importance of this attribute is known to all men who teach or coach athletics. Practically all coaches agree that ability to move quickly is one of the most important factors of athletic proficiency. Most teachers and coaches assume that there is a positive correlation between quickness and success in athletics and are often influenced in the selection of men for teams by observations of their quickness as they participate in activities. There is, however, relatively little objective evidence for such conclusions. Studies that have been made along this line have dealt mainly with specialized athletic events, such as the charge in football or the start in track, and treat only one phase of the sport. There has been a definite need for the study of a more generalized quickness, having as its components movements of the various parts of the body combined into a simple coordinated activity, the elements of which are common to many sports.

METHOD AND PROCEDURE

Since it was the purpose of this investigation to compare quickness of bodily movement in a general sense to athletic success rather than to determine the relationship between specialized techniques of certain sports and successful participation in those sports, it was first

necessary to select for measurement movements of a general nature that were rather common to most sports.

Analysis of the more common sports showed that, in the main, quick movements are required in three directions, namely, forward, to the right and to the left. In baseball the competitor usually moves forward or toward one side. Seldom is he called upon to move quickly backward. The quick movements that are demanded in basketball are for the most part forward or sideward. In football the lineman charges forward and the backfield man makes his quick start either forward or to the side. The same is true for most competitive sports. Most maneuvers are combined arm, leg, and trunk movements directly forward or to the side. It was therefore decided that if the ability to move quickly in these three directions could be measured, the figure thus obtained would represent a rather fair sampling of the movements of many sports.

Since it was the plan to measure the quickness of starting rather than continued speed, such as running, and at the same time to obtain a measurement of more than a simple arm or leg movement—in other words a "total body movement"—the test decided upon was one consisting of a quick action of one arm, one foot, and the trunk combined into one movement, either to the left, to the right, or forward. None of the existing tests and techniques was found to be adequate for measuring this type of action and it was therefore necessary to devise apparatus that would effectively measure "total body quickness."

The test so devised was as follows. The subject stood in a relaxed but alert position, with feet slightly spread and hands on the knees. The heels were placed on a line painted on a rubber mat sealed to the floor. The subject stood directly over a horizontal line marking the middle of the mat. Three targets mounted on rigid movable standards approximately 4 feet high were placed, one on the left, one on the right, and the third directly in front of the subject at a distance of twenty-four inches from the extended fingers of the outstretched arms. A specially designed sliding caliper was used to measure this distance. The targets were oval shaped, masonite panels 5 by 9 inches fastened to heavy copper strips which were in turn hinged to the uprights. The targets were connected electrically to a control box and stop clock in such a way that when any target was touched it fell down and the circuit was broken.

The control box, which was placed on a table directly in front of the subject, was a cabinet with three compartments, each containing a small electric light bulb. On the back panel of the cabinet were three switches, any one of which would light a bulb and start the clock. The front of the cabinet (toward the subject) was flat and contained three perforations in the shape of arrows, one pointing to the left,

one to the right, and one upward (representing the forward movement). Any one of the switches when thrown would illuminate its corresponding arrow. The breaking of the circuit at the target would stop the clock. The timer was an electric stop clock operated by a clutch in such a way that the stopping was immediate. The unit of measurement was 1/300 of a second.

A total of thirty-six measurements was taken of each subject. Eighteen of these involved movements made by the subject when he did not know in which direction he was to start until the illuminated arrow so indicated and the other half were measurements made when the subject was told in which direction he was to move but was required to wait for the signal. The first group represented the type of reaction that is required in defensive situations in athletics whereas the latter movements are more nearly like the actions of a person on offense. In order that no pattern would be set by the operator in the defense type, eighteen cards, six indicating left, six right and six forward were shuffled before the test was started and were drawn one at a time to indicate to the tester which switch to throw. The arithmetic mean of the thirty-six measurements was the figure used to represent the quickness of bodily movement.

RELIABILITY OF THE TEST

Because new instruments and techniques were being used in this test, it was necessary to determine the reliability in two ways, namely, that of the instruments and techniques and that of the test itself. In the first case the split-half method was used to determine the consistency with which the instruments were operated. The odd-numbered measurements taken as a group were compared with the even ones. Thirty-eight cases making a total of 1368 different measurements were used for this purpose. The Pearson Product-Moment correlation coefficient was calculated for the two sets of data with the following result: $r = .96$ ($t = 20.57$). To calculate the significance of this correlation coefficient, the Fisher t test[1] was used and it was found that the probability that such a coefficient of correlation could be obtained from random samplings of uncorrelated measures was considerably less than one per cent, which is ample evidence of real significance. It was therefore assumed that the instruments and techniques used were reliable.

In order to measure the reliability with which the test itself measured the attributes under consideration, namely quickness of bodily movement, the test was repeated on 98 subjects. The quickness scores of the two applications were correlated with a resulting correlation coefficient of .843 ($t = 15.35$, which is highly significant). When the Spearman-Brown "prophecy formula" was applied, it was found that

1 George W. Snedecor, *Statistical Methods* (Ames, Iowa: Collegiate Press, Inc., 1938) 132. The formula used was $t = r\sqrt{(n-2)/(1-r^2)}$.

by tripling the number of cases, r would become .9416. These figures were such as to establish reliability of the test.

Measurements were taken of 755 men and boys in the University of Minnesota; Columbia Heights, Minnesota, High School; and the University of Minnesota High School. All subjects were placed in one of the two main categories, namely, athletes and non-athletes. An athlete was defined as a person who had been retained as a member of a freshman or varsity athletic squad while a non-athlete was an able-bodied boy or man who had not been a member of any organized athletic squad in his institution. A total of 359 subjects were classed as athletes and 277 as non-athletes.

Athletic success was determined by two methods of rating, one of which was based upon performance and the other upon estimates by coaches and physical education teachers. The former was obtained from questionnaires and institution records, while the latter was procured directly from coaches and teachers who were well acquainted with the subjects. In each case the individual was given a rating of A, B, C, D, or E in the following manner.

For performance each subject was given a rating according to the schedule below.

A. Any person who was awarded a letter or similar award for athletic participation.

B. Any person who played in regular games but did not participate enough to receive a letter or similar award.

C. Any person who was retained on a squad but did not play in regularly scheduled games.

D. Any person who tried out for a team but was not included in the squad roster.

E. Those individuals who did not try out for a team or were not out for a varsity sport.

For the rating based upon the estimates of coaches and physical education teachers, the following schedule was used. Those making the ratings were asked to give each subject on their list a letter rating based upon the individual's ability in comparison with all athletes they had had under their direction in the given sport. The standards for rating were:

A. Excellent — approximately the upper 10 per cent.
B. Very good — approximately the next 20 per cent.
C. Medium — approximately the next 40 per cent.
D. Fair — approximately the next 20 per cent.
E. Poor — approximately the next 10 per cent.

Through the above procedures there were obtained for 563 subjects, in addition to the quickness score, one or more estimates of athletic success. These data were used to determine the nature of the relationship that existed between quickness and athletic success in the following ways.

1. The quickness scores of athletes were compared with those made by men classed as non-athletes. This was accomplished by comparing the means of the two groups and by determining the significance of the observed differences.

2. The relationships between quickness and athletic performance ratings and between quickness and coaches' ratings were calculated by means of contingency tables and the resulting coefficients of contingency.

3. Scores made by men who participated in baseball, basketball, football, gymnastics, swimming, track, and wrestling in the University of Minnesota were compared to determine the significance of the differences or relationships occurring in the quickness scores of athletes in the various sports. For those groups in which the samplings were relatively large, the significance of the differences were determined by use of the "Critical Ratio" and the normal probability tables. When large samples were not available, the technique used for determining the reliability and significance of the differences between groups was the Fisher t test[2] which is particularly adapted to small samples.

FINDINGS

Comparison of the scores made by the athletes and non-athletes showed that the athletes as a group scored significantly better than the non-athletes in all three institutions. Table I shows the mean scores and the differences between the two groups.

TABLE I

QUICKNESS SCORES OF ATHLETES AND NON-ATHLETES

	Athletes			Non-Athletes				
Institution	No.	Mean*	Standard Deviation	No.	Mean*	Standard Deviation	Difference in Means	Critical Ratio
Columbia Heights High School	63	218.32	11.33	99	237.91	15.80	19.59	9.15
University High School	39	218.51	13.20	34	232.32	13.28	13.81	4.52
University of Minnesota	257	208.78	13.15	144	229.32	16.36	20.54	12.90

*Figures representing time are in three-hundredths of a second.

In each case the "critical ratio" was considerably in excess of 3, which is customarily accepted as evidence of significance. In no case could the obtained difference be due to chance alone.

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2 E. F. Lindquist, *Statistical Analysis in Education Research* (New York: Houghton Mifflin Company) 56-58.
Snedecor, *op. cit.*, p. 76.

The formula was $t = \dfrac{M_1 - M_2}{\sqrt{\dfrac{\Sigma d_1^2 + d_2^2}{n_1 + n_2 - 2} \cdot \dfrac{1}{n_1} + \dfrac{1}{n_2}}}$

A more detailed study of the scores of the two groups on a percentile basis showed that 8 per cent of the non-athletes in high school and 11 per cent in the University obtained scores that were better than the median of the athletes. Case studies, however, of these individuals showed that they were in reality men of considerable athletic ability who had for some good reason not "tried out" for the teams. Likewise, 9 per cent of the athletes in high school and 8 per cent in the University scored poorer than the median of the non-athletes. Case studies of these men showed that due to above average height or weight they were able to overcome their apparent lack of quickness and could therefore succeed in their particular sports.

Comparison of the quickness scores with the athletic participation ratings and with the ratings assigned to subjects by the athletic coaches and physical education teachers indicated a rather definite relationship between the two.

Table II shows the coefficients of contingency with the appropriate tests of significance.

TABLE II

THE RELATIONSHIP BETWEEN QUICKNESS SCORES AND ATHLETIC PARTICIPATION AND COACHES RATINGS

Group		Contingency Coef. Quickness and Particip. Rating	Chi Square	P*	N	Contingency Coef. Quickness and Particip. Rating	Chi Square	P*
Columbia Heights High School	112	.497	36.6	less than .01	167	.657	52.4	less than .01
University High School	75	.391	13.5	less than .20	73	.647	126.6	less than .01
University of Minnesota	323	.595	177.0	less than .01	299	.447	73	less than .01

*P=probability that a Chi Square as large as the given one could be obtained by chance.

Examination of the data shown in Table II indicates that although the contingency coefficients are not particularly large, they are nevertheless significant and are large enough to show a definite trend and a real relationship between quickness of bodily movement and success in athletics as determined by athletic participation ratings and by ratings based upon coaches' estimates.

One of the most pertinent questions that comes up with respect to the relationship of quickness to success in athletics is that having to do with the correlation between the ability to move quickly and success in various sports in the whole realm of athletics. Is quick-

ness more important in one sport than in another? Can a relatively slow person succeed in one type of athletic event when he would probably not be successful in another?

In an effort to throw some light on such questions, the quickness scores of men in several different sports were compared. Scores of the members of the baseball, basketball, football, gymnastic, swimming, track, and wrestling squads at the University of Minnesota were used for this purpose. Table III shows the scores of these squad members.

TABLE III

QUICKNESS SCORES OF MEN ON SEVEN UNIVERSITY OF MINNESOTA VARSITY SQUADS

Sport	No.	Range	Mean*	Standard Deviation	Standard Error of the Mean	Rank
Baseball	63	51	204.1	13.07	1.65	1
Basketball	90	61	209.8	13.95	1.47	3
Football	79	61	211.5	12.66	1.51	4
Gymnastics	18	55	218.2	14.13	3.42	5
Swimming	20	68	222.1	16.28	3.64	7
Track	31	53	206.1	11.50	2.07	2
Wrestling	48	64	219.8	15.41	2.22	6

*All quickness scores are represented in three-hundredths of a second.

Because most of these groups were relatively small, the significance of the differences between the mean quickness scores of the various squads was determined by the Fisher *t* test. Table IV shows the differences between each sport and every other one included in the investigation. In each cell of the table is found the obtained difference between the mean scores of men participating in the two activities under consideration and figures indicating whether or not this obtained difference was large enough to be significant. An "X" in the cell indicates a significant difference. Examination of this table shows that certain definite relationships and differences existed.

The squad scores seemed to fall into two groups, one consisting of baseball, basketball, football, and track and the other comprising men in gymnastics, swimming, and wrestling. No significant difference was found between the sports within these two groups but there was a decided difference between the scores of the sports of one group when compared with those of the other. The slight differences that existed between the sports of the first group did not justify placing the various activities in any definite order. The relative quickness required by football, baseball, basketball, and track could not be determined by these figures. Likewise there was not sufficient evidence to show that the three activities of the second group differed from each other to any degree in their quickness demands. However, the relatively greater and significant difference between the two divisions seemed to show that the ability to move quickly was more important in the first set of activities than in the second. It seems apparent

TABLE IV

THE DIFFERENCE BETWEEN THE MEAN SCORES ON QUICKNESS TEST OF MEN IN VARIOUS SPORTS SHOWING THE SIGNIFICANCE OR NON-SIGNIFICANCE OF THE DIFFERENCES

	Baseball 204.1	Track 206.1	Basketball 209.8	Football 211.5	Gymnastics 218.2	Wrestling 219.8	Swimming 222.1
Baseball 204.1							
Track 206.1	$D=2$ $Sd=3.8$ $t=.53$ $p>.50.$ not signif.						
Basketball 209.8	$D=5.7$ $Sd=3.14$ $t=1.89$ $p<.10>.05$ not signif.	$D=3.7$ $Sd=3.7$ $t=1$ $p>.30$ not signif.					
Football 211.5	$D=7.4$ $Sd=3.15$ $t=2.35$ $p<.02$ X significant	$D=5.4$ $Sd=3.82$ $t=1.42$ $p<.10>.05$ not signif.	$D=1.7$ $Sd=2.9$ $t=.59$ $p>.50$ not signif.				
Gymnastics 218.2	$D=14.2$ $Sd=4.6$ $t=3.07$ $p<.01$ X significant	$D=12.1$ $Sd=5.4$ $t=2.24$ X $p<.05>.02$ significant	$D=8.4$ $Sd=4.69$ $t=1.79$ $p<.10>.05$ not signif.	$D=6.72$ $Sd=4.99$ $t=1.35$ $p<.10>.05$ not signif.			
Wrestling 219.8	$D=15.7$ $Sd=4.2$ $t=3.75$ $p<.01$ X significant	$D=13.7$ $Sd=4.7$ $t=2.92$ $p<.01$ X significant	$D=10.0$ $Sd=4.1$ $t=2.44$ X $p<.05>.02$ significant	$D=8.3$ $Sd=4.05$ $t=2.05$ X $p<.05>.02$ significant	$D=1.5$ $Sd=5.9$ $t=.26$ $p>.50$ not signif.		
Swimming 222.1	$D=18$ $Sd=5.36$ $t=3.36$ $p<.01$ X significant	$D=16$ $Sd=5.6$ $t=2.86$ $p<.01$ X significant	$D=12.3$ $Sd=5.3$ $t=2.32$ X $p<.05>.02$ significant	$D=11.6$ $Sd=5.2$ $t=2.23$ X $p<.05>.02$ significant	$D=7.5$ $Sd=7.2$ $t=.26$ $p>.50$ not signif.	$D=3.9$ $Sd=7.2$ $t=5$ $p>.50$ not signif.	

D=Obtained difference between means. Sd=Standard error of the difference.
t=Any normally distributed variable divided by its standard error (as determined by the degrees of freedom). Here it is $\frac{D}{Sd}$
p=Probability that a t as large as this could be found by chance.
A p less than .05 is regarded as significant. A p less than .02 is regarded as highly significant.
A p greater than .05 is not significant.
X=significant difference.

that slower boys have a greater chance of success in the latter three sports than in those of the other groups. This fact was further brought out by examination of the personnel of these squads. Experts in the fields of gymnastics, swimming, and wrestling, men who had won national honors in their sports had quickness scores that were poorer than the mean of baseball, basketball, football, and track groups. All these special cases, however, had scores better than the mean of the non-athletes.

CONCLUSIONS

From the findings of this investigation, several conclusions were drawn:

1. There is a positive relationship between the ability to move the body quickly and success in athletic activities.

2. The requirements in quickness of bodily movement are not the same for all sports. A person with relatively slow total body reaction time has a better chance of attaining success in the more individual activities such as gymnastics, swimming, and wrestling than in those sports in which he is required to react to rapidly changing conditions and to the movements of several team mates and opponents, such as is found in baseball, basketball, football, and the like. Men who are not quick enough to achieve proficiency and success in these highly competitive team games might be guided into the more individual type of sport and possibly become outstanding performers.

SUGGESTIONS FOR FURTHER STUDY

Since the results of this study indicated that there is a relationship between quickness of bodily movement and success in athletics and that the requirements in quickness for proficiency in various sports are not the same, it is suggested that further study along these lines might be made with a view toward establishing standards that could be used as criteria for successful participation in these sports. Such standards could also be used for diagnosis and consequent direction of individuals into appropriate sports.

It is furthermore suggested that the relationship between quickness and the various positions or events of a given sport be studied. The purpose of such a study would be to attempt to answer such questions as: (1) Is quickness more essential to success in sprinting than in distance running? (2) What positions on a baseball team require the quickest reactions? (3) In football, is a successful backfield man quicker than a lineman?

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The Development of a Scoring Key on the Strong Vocational Interest Inventory for Women Teachers of Physical Education

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THIS study is an investigation of the vocational interests of Women Physical Education Teachers. The Strong Vocational Interest Inventory (form WA; Adult Women) was the tool employed in the study. This inventory was developed by Dr. E. K. Strong, Jr., of Stanford University, and was first published in 1933. Since that time, it has been widely used for the purpose of investigating occupational interests.*

THE THEORY OF OCCUPATIONAL INTEREST PATTERNS

The Strong Vocational Interest Inventory for Women contains four hundred ten items sampling types of experience ordinarily encountered by women over fifteen years of age. These items cover a wide range of experience including school subjects, recreational activities, extracurricular activities, characteristics of people, and occupations. The items are a sample of the "sum total of all interests (experience) that bear upon an occupational career."[1†]

For every item on the blank, three possible responses are listed. For example, on the item "actress," the individual is instructed to encircle the symbol "L" if she likes that particular occupation, the "I" if she is indifferent to it, and the "D" if she dislikes it. Each response to the 410 items on the inventory has an assigned weight. The individual's score is found by adding (algebraically) the weights attached to all the items on the blank. Eighteen scales have been made for women's occupations, each scale having a different set of weights.

The scoring keys mentioned above are developed from the responses of women "successful" in a given occupation. The criteria for selecting "successful" women vary. The group on which the "Author" scale is based is composed of 135 women listed in *Who's Who in America* and *Who's Who Among North American Authors*. The "Life Insurance Saleswomen" criterion group is composed of 76 women producers of $100,000 or more paid-for production. Other

* The writer wishes to thank Dr. E. K. Strong, Jr., Stanford University, and Dr. Walter Cook, University of Minnesota, for their assistance in this study.
† Superior figures refer to Bibliography at end of article.

criteria used are length of experience, membership in professional groups, annual income, and amount of education.

The interests of the criterion group are compared to a "women-in-general" group. This group is composed of 4,383 subjects; 1,256 are married women. The remainder represents 3,127 women engaged in fifteen different occupations, such as artists, lawyers, dentists, and authors. It is the difference in percentage of response for every item between the criterion group and the "women-in-general" group that provides the weights for scoring a blank for a specific occupation. "Women engaged in a particular occupation have a characteristic pattern of likes and dislikes, which differentiates them from women following other occupations. A score on the Vocational Interest Test for Women is a measure of how nearly a woman's interests coincide with those of the average woman successfully engaged in a given occupation."[5]

Thus, from the scoring of an interest blank the "self-estimate" of an individual's interests, or her interest pattern, is contrasted to the pattern of interests of those successfully engaged in a given occupation. It is assumed that a woman will be more effective in a specific vocation if her pattern of interests is similar to that of other women already successfully engaged in that vocation. Her associations with her professional group will be more congenial and there will be less chance that she will perform tasks that are unpleasant to her.

Inventory scores are interpreted through the use of standard scores and ratings, thus making comparisons between groups and individuals more meaningful. Strong's extensive research has led to the development of approximately fifty keys for occupations of men and women. The validity of these keys leaves little doubt as to the existence of occupational interest patterns.

At the present time, there is research being done indicating the possibility of grouping occupations according to their basic interest type, and developing a general scoring key for that particular interest grouping. Thurstone,[9] Strong,[8] and Darley,[1] have carried out important investigations in the field of factor analysis. The grouping of occupations for women according to the interest type is given below:[1]

I. Technical—Dentist, physician, teacher of mathematics and the physical sciences.

II. Verbal or linguistic—Author, librarian and artist.

III. Business contact—Life insurance saleswoman.

IV. Welfare or uplift—Teacher of social sciences, lawyer, Y.W.C.A. secretary, and social worker.

V. Non-professional interests—General office worker, nurse, stenographer-secretary, and housewife.

PURPOSE

Although scoring keys exist now for dentists, physicians, authors, librarians, artists, life insurance saleswomen, lawyers, Y.W.C.A. secretaries, social workers, general office workers, nurses, stenographer-secretaries, housewives, teachers of social science, mathematics, the physical sciences, and English, no key has been available for use in the field of physical education.

The purpose of this study, therefore, was to provide a scoring key on the Strong Vocational Interest Inventory for women teachers of physical education, to test the reliability and validity of this key, and to determine the interest grouping of those engaged in physical education.

PROCEDURE

The Criterion Group.—510 inventories were sent to teachers meeting the criteria listed below:

1. A four year major in physical education.
2. A bachelor of science degree.
3. At least five years' teaching experience.
4. Possession of a permanent teaching certificate.
5. Engaged as a full-time teacher of physical education on the secondary level.

Two hundred fifty teachers were included in the criterion group. Representation within the group was as follows: Minnesota, 50; New Jersey, 53; Pennsylvania, 142; Miscellaneous, 5.

With regard to size of school system, the distribution of teachers was: cities (population over 10,000), 154; towns and consolidated schools, 96.

The requirement of five years' experience tended to eliminate those who did not intend to make physical education their permanent vocational choice. Since participation in the group was entirely voluntary, it is reasonable to assume that those teachers who returned blanks were more interested in their occupation than those who failed to cooperate.

Other facts pertaining to the criterion group are: the average age, 33.4 years; the average education, 16.5 grades; the average teaching experience, 12.3 years.

Scoring Technique.—The responses of "Like," "Indifferent," and "Dislike" for the 410 items included on the inventory were tabulated. The study was scored twice by two scorers who worked independently of one another. Any discrepancies in the totals for each set of ten blanks were then investigated.

The totals for the various items of the 250 blanks were changed into percentages. The percentage of the response of the criterion group was then compared to the percentage of response for the "women-in-general" group.

Weighting Technique.—The weights for the scale were constructed through the use of the formula (Kelly[2]):

$$W = 100\ \frac{\Delta}{1\text{-}4j\ \Delta\ 2}$$

W = required weight

Δ = disparity between chance and the actual value

$$j = \frac{1\text{-}3\ pq}{p^2q^2}$$

The weighting procedure is illustrated below for the response of "Like" to item 8, "athletic director."

	"Like"	*"Indifferent"*	*"Dislike"*
Physical education group	243	7	0
Per cent of response	97	3	0
"Women-in-general" group	2,280	1,807	296
Per cent of response	52	41	7

PERCENTAGES

	Item Marked	*Item Not Marked*	*Total*
Physical education group	.485	.015	.50 (P)
"Women-in-general" group	.26	.24	.50 (Q)
Total	.745 (p)	.255 (q)	1.00

$p^P = (.745)\ (.50) = .372$ or chance value

$\Delta = .485 - .372 = .113$ (actual value minus chance value)

$$j = \frac{1 - 3\ p\ q}{p^2q^2} = \frac{1 - 3\ (.745 \times .255)}{.745^2 \times .255^2} = \frac{.433}{.036}$$

$j = 12.03$

$$W = 100\ \frac{\Delta}{1\text{-}4\ j\Delta^2} = \frac{.113}{1\text{-}4\ (12.03)\ (.113)^2}$$

$$W = 100\ \frac{.113}{.376} = 100\ (.30) \text{ or } 30$$

Weights over 11 are reduced to 4; therefore the assigned weight for the "Like" response to "Athletic director" is + 4. Similar weights were found for each response on the blank. Weights 11 and above were assigned the weight of + 4; 8 to 10, + 3; 5 to 7, + 2; 2 to 4, + 1; —1 to 1, 0; —2 to —4, —1; —5 to —7, —2; —8 to —10, —3; —11 and over, —4.[5]

"The more the item differentiates the two groups and the less likely it is that the data are due to mere chance, the larger the weighting, and vice versa. A plus or minus sign is assigned to the weights depending upon whether the percentage of the occupational group in question is greater or smaller than the corresponding percentage for "women-in-general."[5]

The interest inventories of the criterion group were scored on the basis of the constructed weights. The mean and standard deviation of the raw scores were calculated. Raw scores were changed

into standard scores. The mean 115.9 was placed at 50, and the standard deviation, 39.6 at 10. All raw scores were changed into standard scores through use of the formula:

$$T \text{ score} = \frac{10\ (X\text{-}M)}{\sigma} + 50$$

In a normal distribution the ratings would be as follows:[5]

Ratings	*Value*	*Percentage of Normal Distribution*
A	$-.5\sigma$ and above	69.2
B+	$-.5\sigma$ to $-1.\sigma$	15.0
B	$-.1\sigma$ to -1.5σ	9.2
B—	-1.5σ to -2.0σ	4.4
C+	-2.0σ to -2.5σ	1.7
C	-2.5σ and below	.6

Ratings on the physical education scale were assigned as follows:

Ratings	*Raw Score*	*Standard Score*	*Percentage*
A	96 and up	45 and up	73.6
B+	76 to 95	40 to 44	11.2
B	57 to 75	35 to 39	7.6
B—	37 to 56	30 to 34	4.4
C+	17 to 36	25 to 29	2.4
C	16 and below	24 and below	.8

In Table I the distribution of scores for the criterion group is given: (standard scores and the ratings are also included).

TABLE I

DISTRIBUTION OF SCORES OF 250 WOMEN PHYSICAL EDUCATION TEACHERS ON THE VOCATIONAL INTEREST SCALE FOR WOMEN PHYSICAL EDUCATION TEACHERS

Score	*Standard Score*	*Percentile*	*Ratings*	*Frequency*
I.	II	III	IV	V
210	74	99	A	1
205	72	99	A	
200	71	99	A	
195	70	99	A	
190	69	99	A	2
185	67	98	A	3
180	66	97	A	2
175	65	96	A	3
170	64	94	A	5
165	62	93	A	2
160	61	88	A	11
155	60	85	A	8
150	59	84	A	3
145	57	80	A	11
140	56	74	A	13
135	55	64	A	25
130	54	58	A	17
125	52	53	A	11
120	51	50	A	9
115	50	45	A	11
110	49	41	A	10
105	47	36	A	12

TABLE I—Continued

Score	*Standard Score*	*Percentile*	*Ratings*	*Frequency*
I	II	III	IV	V
100	46	30	A	15
95	45	25	A	13
90	43	21	B+	11
85	42	18	B+	7
80	41	16	B+	4
75	40	15	B+	4
70	38	13	B	5
65	37	11	B	5
60	36	9	B	5
55	35	7	B	5
50	33	6	B—	3
45	32	5	B—	1
40	31	4	B—	4
35	30	3	B—	1
30	28	2	C+	3
25	27	2	C+	
20	26	1	C+	2
15	25	1	C+	1
10	23	1	C	5
5	22	1	C	
0	21	1	C	
— 5	19	1	C	
—10	18	1	C	
—15	17	1	C	
—20	16	1	C	
—25	14	1	C	
—30	13	1	C	
—35	12	1	C	
—40	11	1	C	
—45	9	1	C	1
—50	8	1	C	
—55	7	1	C	
—60	6	1	C	1

RELIABILITY AND VALIDITY

Reliability.—The chance-halves method of determining reliability was used in this study. The correlation between the odd and even scores, using the Pearson product-moment method, is .72 ± .02. Stepped up with the Spearman-Brown prophecy formula, the reliability of the scale is .85.

Validity.—To determine the validity of a vocational scoring key one of several methods may be used:

1. It may be shown that those successfully engaged in an occupation can be differentiated from those who are not satisfactorily adjusted (unsuccessful) to the occupation.

2. It may be shown that the scoring key differentiates a particular vocational group from other occupations.

3. It may be shown that young people who obtain high rankings on a certain vocational key tend to take up that particular type of work; also, that those having low ratings enter other vocations.

The second method seemed most feasible for this study. Accordingly, 100 of the blanks were scored on the 18 scales available for women. The blanks selected were those belonging to members of the criterion group most representative with regard to age, amount of experience, education, and score on the inventory. The physical education scale does differentiate women in this field from those engaged in other occupations.

The intercorrelations between the physical education scale and 18 other vocational interest scales are shown in Table II.

TABLE II

CORRELATIONS BETWEEN STANDARD SCORES ON THE PHYSICAL EDUCATION SCALE AND 18 OTHER SCALES FOR 100 SELECTED PHYSICAL EDUCATION TEACHERS.

Occupation	r	Standard Error	$\frac{r}{\sigma r}$
Librarian	—.45 ± .05	.079	6
Stenographer	.48 ± .05	.077	6
English teacher	—.25 ± .06	.093	3
Social worker	—.24 ± .06	.094	3
Social science teacher	—.02 ± .07	.099	.2
Author	—.47 ± .05	.077	6
Dentist	—.06 ± .07	.099	.6
Lawyer	—.10 ± .07	.099	1
Life insurance saleswoman	—.03 ± .07	.099	3
Office worker	.49 ± .05	.076	6
Y.W.C.A. secretary	.15 ± .07	.097	2
Artist	—.36 ± .06	.087	4
Masculinity-feminity	.02 ± .07	.099	.2
Physician	—.29 ± .06	.091	3
Nurse	.50 ± .05	.075	7
Mathematics science teacher	.19 ± .06	.090	2
Housewife	.47 ± .05	.077	6
Elementary teacher	.43 ± .05	.081	5

The correlations between standard scores on the physical education scale and 18 other scales for the select group of 100 physical education teachers indicate that the physical education group is most similiar to the occupations of "Nurse," "General Office Worker," "Stenographer-Secretary," and "Housewife." These vocations fall in the category of "Non-professional" interests according to Darley's classification. The interests of the physical education group are least like the "Author," "Artist," "Librarian" and "Teacher of English" interest patterns. These four occupations are classified by Darley as "Verbal or Linguistic." Further evidence of the relationships mentioned above is shown in Figure I.

The average physical education teacher would receive "A" ratings in physical education and nursing, and "B+" ratings in the vocations of stenographer-secretary, general office worker, housewife, and teacher of mathematics and the physical sciences. She would have no "B" ratings, and only two of "B—", that of dentist and social science teacher. "C+" ratings would be assigned in the vocations

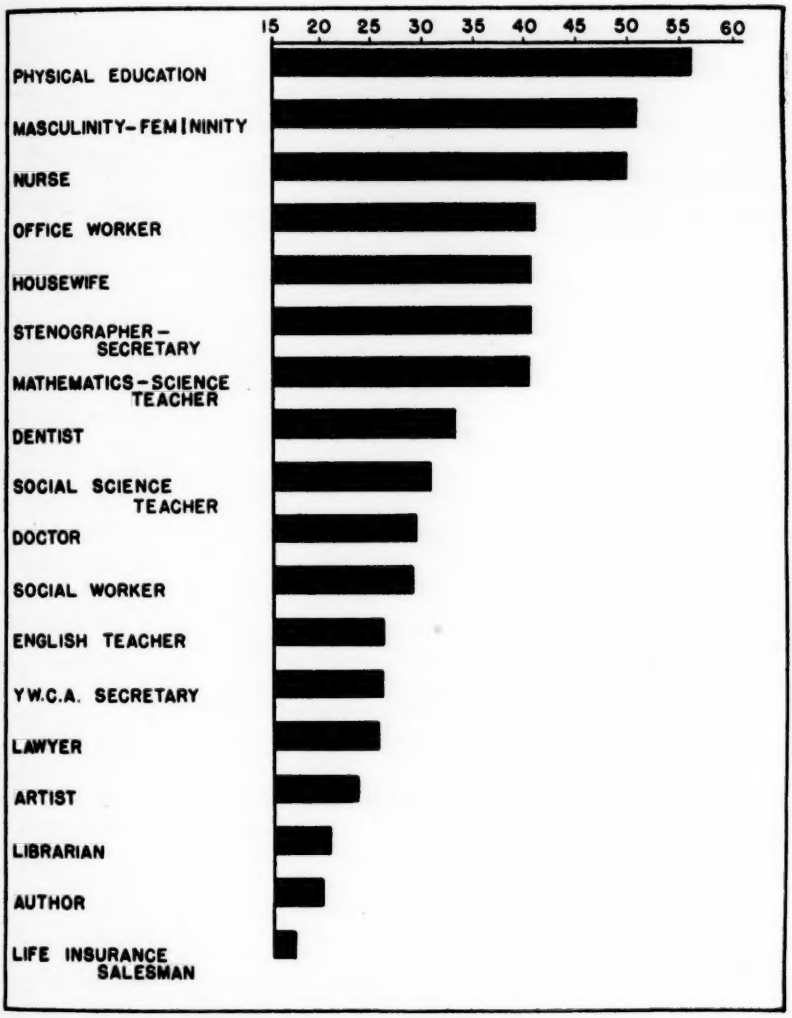

FIG. I. Average standard scores of physical education criterion group on eighteen vocational scoring keys on the Strong vocational interest inventory for women.

of doctor, social worker, teacher of English, lawyer, and Y.M.C.A. secretary. The average physical education teacher would have the lowest possible rating, "C," in the occupations of artist, librarian, author, and life insurance saleswoman.

All the occupations, with the single exception of teacher of mathematics and the physical sciences, in which the average physical education instructor would attain high ratings ("B+" or "A"), are located in the "Non-professional" group, while three of the four vocations

having the lowest assigned ratings (artist, librarian, and author) are designated as "Verbal or Linguistic" in interest type.

The ratings of fourteen sophomore physical education majors on the various occupational scales are shown in Table III. The similarity of interest pattern between the physical education group and the "Non-professional" group is again demonstrated. The lack of agreement between the interests of physical education people and the "Verbal or Linguistic" group is also shown. Only four students received ratings above "B—" on the keys for artist, librarian, and author (the "Linguistic" group).

The data concerned with the relationship between the physical education group and the Masculinity-Feminity scale is not conclusive. It is usually assumed that the physical education group has interests of a more masculine nature. The results of this study do not support this theory. The correlation between the physical education scale and the Masculinity-Feminity scale is —.07. This correlation is somewhat similar to the correlations existing between the "Non-professional" group and the "Masculinity-Feminity" scale. The correlation between "Nurse" and "Masculinity-Feminity" is —.17; between "Stenographer-Secretary" and "Masculinity-Feminity" it is —.18. For "General Office Worker," and "Masculinity-Feminity" the correlation is .02, and for "Housewife" and "Masculinity-Feminity" it is —.03. The range of correlations between the seventeen vocational scales and the "Masculinity-Feminity" scale is from —.47 to .29. Eight of these correlations lie below that for the physical education group, and seven stand above it. It would, therefore, not be correct to interpret the data as showing that the physical education group possesses more "masculine" interests.

TABLE III

VOCATIONAL RATINGS OF FOURTEEN SOPHOMORE MAJOR STUDENTS IN PHYSICAL EDUCATION

Vocation	Letter Ratings					
	C	C+	B—	B	B+	A
Physical education			1	2	2	9
Nurse			2	2	2	8
General office worker			2	2	2	8
Stenographer-secretary		1	1	2	3	7
Lawyer	4	5	2	1	2	
Social worker	4	7	2		1	
Teacher social sciences	5	3	2	2		2
Y.W.C.A. secretary	6	4		2	2	
Teacher mathematics, sciences	6			2	4	2
Dentist	7	2	3		1	1
Teacher English	8	3	3			
Physician	9	1	1	1	2	
Artist	9		2	3		
Librarian	10	2	2			
Author	10	2	1		1	
Life insurance saleswoman	11	2	1			

SUMMARY

The results of this study may be summarized as follows:

1. A scoring key on the Strong Vocational Interest Inventory is now available for women teachers of physical education.*

2. The reliability of the scale, using the chance-halves method, and stepped up with the Spearman-Brown prophecy formula, is .85.

3. The validity of the scale was established by showing that the new scale does differentiate the physical education group from eighteen other occupations.

4. The physical education group is most similar to the "Non-professional" group in interest type.

5. The physical education group is least like the "Verbal or Linguistic" group with regard to interest pattern.

6. The data concerned with "Masculinity-Feminity" of interest of the physical education group is not conclusive.

7. On the basis of the present study, it would be incorrect to state that the physical education group possesses interests of a more "masculine" nature.

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* This key may be obtained from the Stanford Press, Palo Alto, California.

Athletes As Blood Donors

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COLLEGE athletes assert that their occasional employment as "blood donors" does not seriously affect them, and that athletic proficiency either remains the same or is shortly restored to normal. Coaches are definitely against this practice and usually prohibit varsity athletes from acting as "blood donors," unless an emergency demands their services.

There is evidence for both contentions. We have observed in the past a number of cases illustrating the unfavorable effect of loss of blood upon athletes engaged soon after in a strenuous contest. A gymnast and two wrestlers almost collapsed at the end of a competition. An outstanding long distance swimmer lost so much in endurance after a loss of blood that he had to be put on a liver diet. One cross-country runner, taking part in a practice run two days after giving a blood transfusion, developed severe pains in his legs. This condition lasted for two to three days instead of the usual transient stiffness of one day's duration. Another cross-country runner who usually finished first or second relative to his team mates, running on the second day after transfusion, came in last, and it was not until ten days later that he regained his previous endurance.

These observations led to a Springfield College rule that no man may place his name on the blood donors' list while actively engaged in a varsity sport.

On the other hand, we have seen cases where the men did not seem to be affected at all by the loss of one pint of blood. A sprinter and a short distance swimmer each equalled his respective record just a few hours after giving blood for transfusion. Moreover, it has often been observed that although blood donors may feel somewhat faint, or even dizzy, after the withdrawal of a pint of blood, this condition is usually transient and soon may be succeeded by a state of euphoria.

Our interest in this question was again aroused by an incident during an experiment in training. A strong young man who had been in daily training on a stationary bicycle for nine weeks, announced one day, after completing his daily ride, that he had lost 500 cc. of blood the previous day; however, his riding time showed

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no decrease. Although this unauthorized loss of blood somewhat complicated our original experiment, we watched with great interest his performance on subsequent days. On the following day his riding time decreased (see Fig. I-a) and it took him three weeks to regain his pre-transfusion endurance. Two weeks later, with our permission, he "donated" 500 cc. of blood. This time performance showed an immediate fall (Fig I-b), and it again took about three weeks to come back to normal.

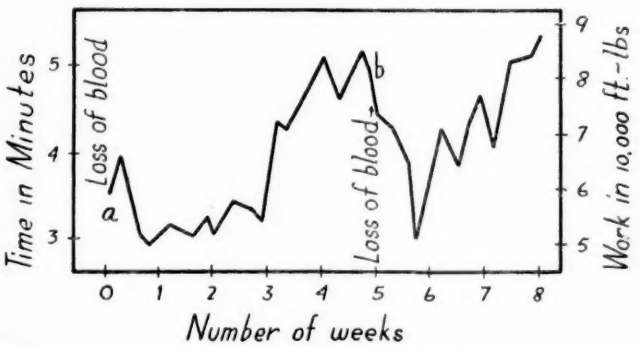

FIGURE I. Subject J. L., working on a bicycle ergometer at a rate of .507 horsepower, 117 pedal revolutions per minute. Point *a* indicates loss of 500 cc. of blood for transfusion and point *b* a similar loss five weeks later. It took three weeks to recover completely from the effects of the loss of blood.

This particular subject, J. L., was working at the rate of 0.507 horsepower, or 16,731 foot-pounds per minute, and he was able to maintain this strenuous rate for four minutes before the first transfusion and for five minutes before the second transfusion. An average man working at such a rate becomes exhausted in about one minute. Therefore, the exercise performed by the subject J. L. belongs in the class of endurance exercises in which the supply of oxygen during the activity itself is more important than the oxygen debt.

To check these observations, we carried out additional experiments on four men, two of whom were bled twice. These subjects were also tested on bicycle ergometers. With the exception of one case, performance was worse on the day of transfusion and the following day. After this period, their performances differed. If the exercise was of the "sprint" type, repeated once a day and lasting about one minute, performance remained normal during the three to four weeks of the observation; but if the work was more of the endurance type, there occurred a marked phase of depression, lasting in some cases from ten to eighteen days.

It is of interest to explain why some men, including the subject J. L., showed an increase in work output on the day following blood

transfusion. In the case of the first observation on this subject, the increase seems to be definitely the effect of motivation. He knew that he was not supposed to "donate" the blood, and for this reason he tried his utmost to prove that it did not affect him unfavorably. When he finished his exercise, exceeding his usual time by 15 seconds, he was utterly exhausted. On the second occasion, when he had our permission for the blood transfusion, the drive motive was not the same, and the performance followed a more normal physiological course.

CONCLUSIONS

1. The loss of 500 cc. of blood unfavorably affects athletic performance.

2. In exercises of endurance, performance is decreased, and ten to twenty days elapse before a return to normal.

3. In exercises of speed, performed once a day lasting about a minute and depending mainly on oxygen debt, performance may not be affected.

4. Performance on the day of the loss of blood, and the following day, is usually lowered, but occasionally it may be slightly increased. This increase is probably due to summation of the concomitant exciting factors. In our study the slight increase in two cases was probably due to a frantic effort to prove that loss of blood did not affect the subjects seriously.

5. Varsity athletes should be discouraged from "donating" blood, with the exception of cases of dire emergency.

Acknowledgement.—We wish to thank the College Surgeon, Dr. Fred S. Hopkins, and the Resident Nurse, Mrs. Mildred D. Emery, for their cooperation in this study.

A Study of the Effect of Different Physical Education Programs on the Strength Index of Ninth-Grade Boys

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IN LARGE cities where there are several high schools, the programs of physical education often vary in each high school. There is no uniformity, not even in some of the basic activities. Where there are five high schools one is apt to find five different programs. Such a condition is often reflected in the development of the pupils.

While conditions in one high school may make it impossible to use a program similar to one used in another, the situations are never so different that certain basic activities, suited for any situation in any high school, could not be agreed upon for all. Conditions common to all high schools should determine the basic program. Conditions peculiar to each high school should determine the remainder of the program. This is a very desirable arrangement.

To determine whether the programs in vogue in the different high schools varied in their effect on pupils' strength, Superintendent DeWitt S. Morgan of the Indianapolis Public Schools, in cooperation with the high school principals, suggested that the Department of Physical and Health Education carry out an experiment to answer this question.

After a careful study of test literature, we decided to use McCloy's Strength Test[1] as the one that would be most practical, suitable, and reliable to determine the effect of any program on the strength index of pupils. There seems to be general agreement among research students in physical education, concerned with the scientific aspects of tests, that strength is the most important factor in all forms of motor ability. The pupil with a high strength index is likely to play better in any game, make a better showing in athletic events, and perform better in any activity, including his daily work, than one less developed in strength. Accordingly, McCloy's strength test was carefully studied with the view of applying it in this experiment.

A test group, a control group, and a basic control group were organized. Each high school, however, did not have all three groups in its organization for the test. Each of four high schools had a control group, three a basic control group, and all a test or experimental

1 C. H. McCloy, *Appraising Physical Status: Methods and Norms* (Iowa City: University of Iowa, 1938) 60-67.

group. The reason for this arrangement is explained later. The high school principals agreed to keep these groups intact for the entire school year.

PURPOSE AND ORGANIZATION OF THE EXPERIMENT

The purpose of the experiment was to discover whether programs of activities, different in quantity and quality, would affect the Strength Index of grade IX boys differently. Three groups were organized as explained below, each following a different program:

A. An experimental or test group instructed according to the revised program of activities for boys, grade IX. Conducted in each high school. A new series of activities was practiced each cycle (six weeks).

B. A control group, instructed according to a program in vogue in the high school for grade IX boys. Conducted in high schools A, B, C, and D. In three high schools (E, F, G) no control groups could be organized because all classes were being taught according to the revised program of grade IX which was introduced in 1939-40.

C. A basic control group, practicing the military training program and not participating in physical education. Conducted in A, F, and D. It was not possible to organize basic control groups in other high schools. The term "basic control" was chosen to distinguish this group from the "control" group.

Each class had five 40-minute periods each week, one of which was devoted to health instruction. After deducting time for dressing and showering, about 22 to 25 minutes were left for activities.

ACTIVITIES OF THE TEST GROUPS

The revised physical education program used by the test groups has a distinctly scientific basis. It consists of (1) a time run and variations, (2) rhythmic conditioning exercises, (3) basic events, and (4) game fundamentals.

1. A time run and variations. Purpose: to develop heart and lung power.

2. Rhythmic conditioning exercises. Purpose: to supple and strengthen parts of the body, to improve posture, to develop the sense of rhythm and ability to relax. A group of effective exercises were selected for the lessons of each cycle.

Specific Objectives of Rhythmic Conditioning Exercises.—The following specific objectives, which give an overview of the purpose of this class of activities, are taken from the course of study.

a) Leg exercises. To supple ankle and knee joints and strengthen the muscles of the leg; to stimulate mildly the circulation and respiration.

b) Shoulder girdle exercises. To make the arms and the shoulder girdle flexible; to stretch the pectoral (chest) muscles; to

strengthen muscles of the arms and shoulder girdle; to know that these exercises help to establish a good posture of the upper trunk. To realize that these results improve ability to throw, strike, bat, and otherwise make possible efficient use of the arms.

c) Pelvic girdle exercises. To supple the hip joint in a lateral and in an anteroposterior (fore-backward) direction by stretching the hamstrings and other tissues surrounding the joint. To realize that a supple hip joint makes possible the establishing of the correct tilt of the pelvis and thus prevents hollow back (lordosis); and that it improves freedom of hip movement necessary in high jumping, hurdling, kicking, running, in the jack knife dive and similar activities.

d) Lateral trunk exercises. To improve flexibility of the spine in a lateral direction by stretching tissues; to strengthen trunk muscles. To realize that strong muscles and a flexible spine are necessary for a fine functioning body and for posture.

*e*1) General trunk exercises. To maintain and improve flexibility of the spine in all directions.

*e*2) To strengthen muscles that maintain an erect position of the trunk; to realize that this improves posture.

f) Tensing and relaxing exercises. To develop ability to tense and relax the body or parts of it; to realize that these two phases are important in all sport activities, games, athletics, dancing.

g) Abdominal exercises. To strengthen abdominal muscles; to realize that strong abdominal muscles hold the abdominal viscera in correct position and are a great help in all vigorous activities.

h) Posterior trunk exercises. To strengthen the posterior trunk (back) muscles; to stretch the pectoral (chest) muscles. To know that strong back muscles are needed to keep the trunk erect; to know that tight pectoral muscles pull shoulders forward and produce stooped shoulders.

i) Rhythmic swinging exercises. To produce a rhythmic, harmoniously functioning body; to improve the rhythmic sense. To realize that rhythm is an essential principle in all body activities; to know that rhythmic performances save energy.

Between some of the specific exercises, such activities as head turning; lowering forward, backward, and sideward; shoulder raising, lowering, and moving forward and backward are occasionally practiced, as also certain foot exercises.

3. Basic events. Activities to develop organic power, neuromuscular power and skill, and muscular strength. They are divided into four groups:

a) Activities to develop organic power, as the various dashes, relays, and time runs chosen from appropriate track and field events.

b) Activities to develop the interaction of muscles and nerves when maximum or near-maximum strength is a factor:

(1) Of the upper extremities and shoulder girdle; e. g., the various (track and field) throws, puts; stunts on floor and apparatus; and some game skills.

(2) Of the lower extremities and the pelvic girdle; e. g., the various (track and field) jumps; some stunts and game skills.

(3) Of the entire body, as in tumbling or mat work.

c) Activities to develop the interaction of muscles and nerves when a moderate amount of strength is a factor, as game skills; some stunts; fundamentals selected from soccer, touch football, volleyball, basketball, softball.

d) Activities to develop strength of local muscle groups as chinning, push-ups, sit-ups, some floor stunts.

At the beginning of each cycle, each teacher received descriptions of the basic events, their techniques, how to measure achievement, and methods of procedure.

4. Games. Teaching the playing of our traditional games in season, the use of lead-up games and the development of fundamentals of games as indicated in item 3.

ACTIVITIES OF THE CONTROL GROUP

These differed in the four high schools in which they were conducted. Chart I explains the contents of the lessons as submitted by the teacher and as observed by the writer in each high school (A, B, C, D).

ACTIVITIES OF THE BASIC CONTROL GROUP

This group of boys received no instruction in physical education, but in military activities (tactics) only.

PROCEDURE

At the beginning of the experiment, all boys of the three groups were given a medical examination. Those unfit to participate in the test were excused. This was followed by the strength test given by the instructor and recorded on a prepared card. It consisted of strength of left and right grip, back, and legs, and pull-ups and push-ups (parallel bar). The test was administered as described by McCloy and the results computed as suggested by him. From the cards, the score of each item of each pupil was transferred to a sheet, so organized that the scores could be compared and totalled. Each age group was treated separately, making possible a comparison of the ages.

Regular teaching procedure followed, during which the respective programs of activities were taught. In a few instances teachers of test groups measured pupil achievement in the basic events at the beginning and end of a cycle to note improvement. At the conclusion of the experiment the strength test was again given by the instructor. The tables show the results.

CHART I

A	B	C	D
Control Group: 1. Marching and free exercises* three times weekly. 2. Other activities: apparatus once weekly; games and relays, team games, athletic events once weekly. *Selections from rhythmic conditioning exercises of the test program and other free exercises.	*Control Group:* 1. Conditioning exercises. 2. Basic skills—conditioning exercises were the same for long periods. The list of events was selected from a different point of view than those of test groups.	*Control Group:* 1. Free exercises (Illinois program and variations) on alternate days; also as part of period (run to field during outdoor work). 2. On different days: games and game skills whole or part of period. Relays as games. Tumbling whole period. Individual athletic events as games. Some apparatus tests (once in two weeks).	*Control Group:* M—health. T—calisthenics,* mats, or apparatus. W—calisthenics, basketball, (seasonal) skills. Th—calisthenics, relays, mass games, contests. F — volleyball, (seasonal games). *Selections from rhythmic conditioning exercises of the test program.
Test Group: Run and rhythmic conditioning exercises daily, 7-10 minutes. Games and relays or basic events on alternate days, 15-18 minutes.	*Test Group:* Locomotor and rhythmic conditioning exercises daily, 7-10 min. Games, game skills, relays, or basic events on alternate days, 15-18 minutes.	*Test Group:* As other high schools. Runs frequently omitted because of prevailing conditions.	*Test Group:* Time run and rhythmic conditioning exercises, 7-10 minutes. Games, relays, contests, and basic events on alternate days, 15-18 minutes.
Control group taught by Mr. P. until second semester. Test group by Mr. R. Both control and test groups taught by Mr. R. after that.	Both groups taught by Mr. S.	Both groups taught by Mr. T.	Both groups taught by Mr. U.

INTERPRETING THE DATA AND DISCUSSION

By totalling the gains and losses of each group in all high schools, certain individual discrepancies probably caused by inaccurate measurements, disappear. In pooling these totals the gains and losses produced by inaccuracies cancel each other to some extent. Furthermore, the discrepancies are not enough to affect the correct measurements, so they may be said to be eliminated.

TABLE I

AVERAGE GAIN OR LOSS PER PUPIL IN EACH HIGH SCHOOL IN THE STRENGTH INDEX FROM FIRST TO SECOND TEST

High School	Test Group 14 to 14-11	Test Group 15 to 15-11	Test Group 16 to 16-11	Control Group 14 to 14-11	Control Group 15 to 15-11	Control Group 16 to 16-11	Basic Control Group 14 to 14-11	Basic Control Group 15 to 15-11	Basic Control Group 16 to 16-11
A	110.8 (27)*	163.0 (3)	—97.2 (1)	1.4 (26)	1.6 (4)	No pupils	50.6 (11)	No pupils	No pupils
B	99.9 (21)	120.1 (8)	59.3 (2)	91.5 (22)	28.9 (5)	51.5 (2)	No Basic Control Group		
C	134.9 (25)	131.8 (11)	103.4 (6)	113.3 (16)	137.5 (12)	334.5 (1)	No Basic Control Group		
D	47.2 392.8 (11)	189.6 604.5 (3)	77.4 142.9 (1)	108.6 314.8 (9)	129.9 297.9 (7)	93.7 479.7 (2)	—26.6 24.0 (9)	83.1 (13)	15.6 (11)
E	161.0 (3)	21.7 (5)	329.9 (1)	No Control Group			No Basic Control Group		
F	125.9 (13)	201.6 (7)	149.2 (3)	No Control Group			39.4 (13)	42.7 (12)	50.6 (7)
G	129.6 (20)	214.5 (3)	188.3 (2)	No Control Group			No Basic Control Group		
Total	809.3 (120)	1042.3 (40)	810.3 (16)	314.8 (73)	297.9 (28)	479.7 (5)	63.4 (33)	125.8 (25)	66.2 (18)
Average Per School	115.6	148.9	115.7	78.7	74.5	159.9	21.1	62.9	33.1

* Figures in ( ) indicate the number of pupils in the group at end of the test.

According to Table I, pupils of the test groups made greater total gains than those of the other two groups. For instance, when the total gains are divided by the number of high schools, the average is as follows:

Age 14, test groups, scored 36.9 points more than the control groups, and 94.5 points more than the basic control groups.

Age 15, test groups, scored 74.4 points more than control, and 86 points more than basic control.

Age 16 presented so few cases that it has been omitted in the comparisons.

Examination of the scores of the individual high schools shows four instances in which the control groups have made greater gains than pupils of the same age in the test groups (D, 14 yrs., C, 15 yrs., and two groups of 16-year-old pupils).

Comparing the scores of only those high schools which had both test and control groups (A, B, C, and D) the results as shown in the table are:

Age 14, test groups, 392.8; control groups, 314.8.
Age 15, test groups, 604.5; control groups, 297.9.

In schools where the revised program had been regularly used, a difference in the results is noticed when compared with the results of test groups in other schools.

Table II has been prepared to show the changes from the first to the second test in percentage.

Showing the gains in percentages gives a more accurate figure of the changes and a more precise picture of the gain in achievement from the first to the second test.

Thus, per high school, when all are considered:

Age 14, test group, improved 10.28 per cent; control, 4.71 per cent; basic control, 1.54 per cent.

Age 15, test group, improved 17.81 per cent; control, 7.74 per cent; basic control, 5.82 per cent.

If only those high schools containing both test and control groups (A, B, C, and D) are compared, these total gains are as follows:

Age 14, test group, improved 26.05 per cent; control groups, 18.86 per cent.
Age 15, test group, improved 97.87 per cent; control groups, 30.27 per cent.

Individual high school scores show three instances, one of which is in the 16-year-old group and not given, in which pupils of the control group made greater gains than those of the same age in the test groups (B, 14 yrs.; C, 15 yrs.).

The result of the examination of the gains of all cases in each age level and in each group for the median, the Q1, Q3, and Q, is expressed in Table III.

This table further emphasizes the fact that the test group scored higher gains than the control and basic control groups. There is a marked difference between the medians of the three ages in the test group and in the control group (116.7 vs. 64.6; 144.4 vs. 88.2 and

TABLE II

PERCENTAGE OF AVERAGE GAIN OR LOSS PER PUPIL IN STRENGTH INDEX FROM FIRST TO SECOND TEST

High School	Test			Control			Basic Control		
	14 to 14-11	15 to 15-11	16 to 16-11	14 to 14-11	15 to 15-11	16 to 16-11	14 to 14-11	15 to 15-11	16 to 16-11
A	1.54	7.89	—.63	—2.51	7.44	No pupils	4.71	No pupils	No pupils
B	9.40	69.80	10.39	11.10	2.66	4.82	No Basic Control Group		
C	8.24	5.19	13.22	6.26	9.33	7.78	No Basic Control Group		
D	6.87	14.99	7.10	4.01	10.84	14.20	—4.12	8.21	—.81
Total	26.05	97.87	30.08	18.86	30.27	26.80	.59	8.21	—.81
E	23.00	—1.80	30.00	No Control Group			No Basic Control Group		
F	13.00	19.30	18.50	No Control Group			4.05	3.44	4.98
G	9.96	8.35	21.13	No Control Group			No Basic Control Group		
Gr. Total	72.01	123.72	99.71	18.86	30.27	26.80	4.64	11.65	4.17
Average Per School	10.28	17.81	14.24	4.71	7.74	8.93	1.54	5.82	2.08

122.1 vs. 90.1); likewise in the basic control group. Also between the twenty-fifth percentile (excepting in the 16-year olds) and the seventy-fifth percentile. In one instance (15-year olds) the twenty-fifth percentile of the basic control group is greater than that of the control group.

TABLE III

INTERQUARTILE RANGE OF PUPILS' T.S.I. OF TEST, CONTROL, AND BASIC CONTROL GROUPS

Group	Age	Median	Q1	Q3	Q
Test	(120)* 14 to 14-11	116.7	36.6	178.7	71.0
	(40) 15 to 15-11	144.4	69.2	226.6	78.7
	(16) 16 to 16-11	122.1	1.3	203.2	100.9
Control	(73) 14 to 14-11	64.6	—14.6	128.8	71.7
	(28) 15 to 15-11	88.2	3.6	153.3	74.8
	(5) 16 to 16-11	90.1	8.7	178.8	85.0
Basic Control	(33) 14 to 14-11	24.0	—30.2	55.5	42.8
	(25) 15 to 15-11	54.0	27.5	95.0	33.7
	(18) 16 to 16-11	34.9	—7.3	73.6	40.4

* Figures in ( ) indicate number of pupils in group.

CONCLUSIONS

1. The result of the experiment verifies a generally accepted fact, namely, that quantity and kind of activities comprising a program determine its value for physical development.

2. A program planned to achieve specific results can produce a strong, efficient body.

3. In general, greater physical development seems to have been achieved by the program used by the test groups than by those in vogue in the individual high schools and used by the control groups.

4. A fairly uniform program for all the high schools, planned to produce specific results, seems desirable.

5. R. O. T. C. pupils seem to gain but little in strength from their activities.

Reading Defects and Vision

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NEARLY fifteen years ago the writer first consciously began to observe in so-called non-readers what appeared to be defects of vision of which there was no record on school medical reports. The strange thing was that socially normal children, alert and well-informed considering their opportunities in life, who had "normal" vision had never learned to read. In psychological tests they were rated reasonably intelligent, not bright, not very dull, yet they did not know how to identify even the shapes of letters and under ordinary reading routine did not learn to do so. In fact, in their attempts to learn they did not learn to recognize what they should have been able to see if they had been much duller than any tests and their general information proved them to be; actually duller children in classes for backward children were learning to read. It appeared more and more that large numbers of socially normal children were not learning to read or were learning very little. Some could not discriminate between letters, between words: some did not see the difference between O, C, G, etc.; some could not learn to do so; some could not even match two of a kind, even where the outline was the same.

It seemed, however, to the writer that any child with good enough brains to make him socially normal should be able to learn to read the words and sentences whose meanings he knew (and showed in conversation that he really did know), provided his eyes were normal and functioned normally. Therefore she set about trying to determine whether or not these non-readers did have "normal" enough vision to distinguish the print on the page. She wanted to find out exactly how much and how well these non-readers could see in actual practice. In most cases, the school doctors returned the same verdict after a second routine check-up as on the first report. It would therefore be necessary to use more tests than the school doctor used, and to analyze the child's behavior which might have bearing on his poor seeing response.

There is, of course, probably such a thing as a specific gift or a specific defect, as in music, art, and sculpture; not all persons are equally endowed and some persons appear to have very little talent. But nearly everyone can sing and play a little, draw more or less recognizable pictures, or mold figures in clay. Why then should so large a number of capable children not learn to read, not learn some-

times even one word? For example, in one school where careful grading for reading was the rule and where teaching follows the child's capacities, there were, out of 245 socially fairly bright children in grades II, III, and IV, 15 children who did not read one word, 64 others who were one to three years below grade requirements. In the same school, of a total of 165 pupils in grades V and VI, there were 55 children who rated a year or more below standard according to various reading tests generally recognized as trustworthy and according to the requirements of the conventional city course of study.

A few parents were willing to have eye examinations and secured glasses, despite the "normal" showing on the school records. The school examinations had been made by a very conscientious doctor, but the eye defects reported back included some which his standard routine could not possibly have discovered: mixed astigmatism, moderate astigmatism, no refractive error but squint (in one or both eyes), considerable hyperopia, moderate myopia, one or both eyes oblique, no binocular vision, eyes on different planes, left eye lower, etc. Here was evidently a clue.

With these facts established, increasingly systematic observations followed and this is what gradually unfolded: practically all non-readers of ordinary social capability and most non-readers of all degrees of intelligence proved to have some visual defect. Our interest was only in the first group, the non-readers of fair social intelligence.

A number of units in various schools were examined one after the other and the results were acted upon by the schools. The examiner began with no particular plan and what follows is not uniform enough to please a statistician, but the disparity between school reports about the eyes and actual conditions is very clear. The recurring testimony of each group is striking.

Three regular grade classes of 107 socially normal children were first examined to see how many could see as well as the routine school examination implied. There was no reason to suppose in this group that the routine examination had not been well done. Twenty children had been told that they needed glasses, and 4 already owned and were wearing glasses. Of the total number, 45 apparently could see clearly and 62 could not when using both eyes together; that is, 38 of the 107 had some defect not revealed by the routine examination. The school doctor had discovered 20 percent, but there were probably 60 percent whose two eyes did not see clearly when used together.

In another group, this time non-readers, all socially capable, 106 of the 112 did not see clearly with two eyes used together! Six were low-grade in other respects, but of the total, only 15 wore glasses.

In another class of non-readers, 2 had squint on their medical reports; 27 were rated 15/15 : 15/15 or "normal"; with both eyes together, only 3 of the 33, or 9 percent, could see as well with both

eyes together as they could with each eye alone. Only 3 (who showed no serious eye difficulty) had defects usually called "mental." Thus there were more (30 out of 33) non-readers who had been handicapped by poor vision than were handicapped by "backwardness." Seven tested farsighted; the rest with both eyes together were nearsighted, although not with the two eyes used one at a time, that is, there was as yet too little fusion. Some of these showed that the eyes did not converge, that one eye jumped outward, that the eyes alternated rapidly. Only a few learned to force the focus in the time allotted to the examinations. Some did learn that they were expected to make themselves see as well with two eyes as with one, that they had never seen things as they really are to most people.

In another school, 21 of the 79 non-readers tested had already been found to have visual defects, most of them (19 of the 21) already wearing glasses or expecting to get them.

In 4 groups aggregating 169 non-readers or near non-readers tested, 24 had already been reported as eye cases although only 10 wore glasses, 29 were also backward enough to make reading difficult, 140 did not see clearly enough to learn by regular classroom procedures, 130 had not had their defects corrected, if they were correctable, some had not even suspected that they were in need of help for visual difficulties (not necessarily in need of glasses).

Another group of 106 non-readers or near non-readers in various grades contained only 7 who could be called backward. Of these 106 children, 80 have at the time of writing already had their eyes examined at hospital clinics. Eleven were refused glasses or were to be re-examined later, 69 received glasses, and 22 are still to be examined.

In a group of 125 non-readers, only 4 were backward enough to be placed in a special class, 14 were refused glasses, to be re-examined later, 52 received glasses, 60 are still to be examined by oculists. In no case was the child sent or taken to an oculist who did not show during the examination by the psychologist that he or she did not see clearly. With the detailed report of such preliminary tests, the oculist did not say at any time that the "child will grow out of it" nor that minor defects were of no importance.

The next group of 69 showed that 64 needed glasses and these were secured at once.

In a list of 201 non-readers in one school, the school doctor himself had already reported 15 children with squint and 190 nearsighted, of whom 40 already wore glasses. Closer examination added 7 children who needed glasses for farsightedness, and revealed that for 67 of the 190, the eyes were nearsighted in different degrees—for example, 15/15 : 15/30 or 15/20 : 15/30. This conditions is a greater handicap than having two eyes which, though nearsighted, are alike.

Since there was originally no thought of sumarizing or reporting these findings, the data are not equally detailed for all children, notably as to the variations between the eyes. The earliest tests paid no attention to the eyes individually, all tests being tried out only with the two eyes used together. In the following paragraphs we shall report the differences between the routine medical examination rating for each eye alone indicating "normal" vision and the results when using the eyes as under normal conditions of the classroom.

In a class of 34 beginners were only 4 who could see as clearly and as far with both eyes together as with each separately; that is, fusion had been established for only 4; 2 of the 34 were farsighted, using the eyes together or separately. At near points these two children showed that they did not see clearly. The rest showed varying degrees of failure to fuse or what looked like nearsightedness but was not. With both eyes together 15 gave 15/20, 8 gave 15/30, 3 gave 15/40, and 2 could not see the 40-foot line at 15 feet.

Of 104 children in three classes, only 69 had been examined by the school doctor and these were rated normal except for 5. Examination with the two eyes together showed 99 of the 104 with blurred or slow seeing and only 5 whose vision was clear and accurate.

In a group of 46 where the doctor found two defects, the writer found 22 when the children used both eyes. In a check-up for himself, the astonished doctor willingly admitted that children do not always see as well with both eyes together as they do with one eye at a time, although he had always supposed the contrary.

In a class of 43 slow readers, the school doctor found 16 children with eye defects; 25 more had obvious defects when using the two eyes together, 5 of these showed poor muscular control of the eyeball movements, and 19 did not show proper convergence.

In a group of 47, the school doctor found 23 appreciable eye defects. The writer found 19 more. Of a group of 38, the doctor found 25 and the writer added 11 more; of the 36 defects, 19 were connected with muscular control and convergence.

Of a total of 801 children, either slow-readers or non-readers, the school record showed only 272 eye defects, while 493 more children proved to have defective vision of some sort.

In all the cases examined by the doctor, not one single case of farsightedness was reported, although young children are supposed to start out farsighted and to reach maturity in this matter at various ages. This is partly because most school charts are, or at least always have been, so arranged as to make testing for farsightedness difficult. The tester could, of course, easily place the child farther away to gain distance for the 15-foot line of figures or letters. Some of the doctors' rooms are very small and so arranged that the chart cannot be

seen from a distant point. However, most doctors could manage if the regulations demanded it.

Comparing 478 of these 801: the school had no examination at all for 67 and the writer did not test 58 who already had glasses, merely using their records. The school (using the two eyes separately) had tested 319 children as normal. The test for the two eyes together found only 67 pairs of normal eyes; with two eyes used separately, 65 cases with 15/20 : 15/20, and with both eyes 186 cases. This showed that some of the children with normal eyes did not yet have fusion. With eyes used separately, 23 cases rated 15/30 : 15/30; together, 98 cases. With eyes tested separately, 4 cases were 15/40 or worse; with both eyes together, 38 cases. In each category a large proportion showed that the difference was indeed due to the fact that the two eyes did not work together.

Counting 15/15 : 15/15 and 15/20 :15/20 as normal enough, there were 384 normal pairs of eyes when tested separately, but only 253 pairs when both eyes were tested together, and instead of 92 nearsighted pairs there were 136 pairs that acted nearsighted. With the 31 pairs of farsighted eyes already mentioned there were 167 defects instead of 92 which the routine examination had uncovered.

As the testing went on, the children were given more tests and different tests to reinforce the findings above. A group of 147 showed 36 children with observable squint, 102 did not move their eyeballs in unison, and 46 showed almost rhythmical alternating in the use of the eyes.

Among the 478 non-readers described above, 82 showed practically no convergence at reading distance, 231 poor convergence, 135 poor control of the muscular movements, but 30 more learned to do better during the examination practice.

Fewer tests were made for eye-hand dominance, but these proved interesting enough to call for more study. Only 230 of the 478 were tested for dominance, but these are the results:

Right-hand—right-eye	102
Left-hand—left-eye	22
Children not sure	38
Mixed dominance	68
Right-eye—left-hand	4
Left-eye—right-hand	49
Could use left hand	15

Those who were not sure of the eye and hand seemed to have squint, but this could not be proved for more than one child, for lack of time and medical help.

Vagaries of dominance may have more effect upon reading efforts than we think. Some of the left-eye—right-handed may merely have been right handed by training, since 15 could use the left fairly

well without practice. Of course, some knew that they were originally left-handed. Note that among the 230 non-readers only less than half had the right-eye—right-hand habit, while nearly 10 per cent were entirely left-eyed and left-handed. Nearly 50 per cent had mixed dominance. A check should be made in future studies on the relation between the handedness and the efficiency of the dominant eye. The writer has some data already but their importance is not clear.

In one school where an enthusiastic nurse and a liberal-hearted principal cooperated, more than 80 percent of the referrals of "normal" eyes to eye clinics were immediately diagnosed as eye cases and given glasses. Some of the children who according to the first examination did not need glasses were re-examined later at the same clinic and were then given glasses. Some were re-examined at other clinics; some received orthoptic assistance.

Some children, even after several examinations, were refused glasses without explanation, and it was assumed that such children had defects which could not be remedied or else could not be discovered by existing methods. The eyeball itself may in all respects seem to be perfect but the child cannot see, and the defects can only be guessed. The complexity of the problem of cure and correction is medical, but the teacher who sees the results of the defects in a child's behavior which no eye specialist can clear up or even explain to the layman need not therefore feel that her own diagnosis is wrong. So far as his learning goes the child shows that he does or does not see, just as much as the blind person does when he cannot see a ball in front of him. And it is foolish to insist that the child does not see just because he is dull. Why the child does not see clearly is perhaps not the teacher's business, but she can know that he does not see clearly and present her evidence to the medical examiner for assistance.

SUMMARY

1. The farsighted among non-readers are more numerous than might from school records appear to be the case. Sufficient testing might prove that a moderate degree of farsightedness is as frequent as moderate nearsightedness, and just as much of a handicap in school work, and probably far more so for reading and spelling. The nearsighted never have the headaches and eyestrain and the attendant nerve-strain and fatigue which may often beset the farsighted individual. By means of our school tests we discover the nearsighted but not the farsighted.

2. Functional difficulties are frequently the cause of poor seeing, but only gross defects are reported or can be uncovered by the ordinary routine examination. For non-readers minor functional defects are sometimes serious.

3. There is some relation between eye-hand differences (dominance) and the child's use of his eyes and non-reading.

4. Not being able to learn to read is not a sign of stupidity or backwardness. Stupid people may not learn to read, but not learning to read may be caused largely or wholly by poor vision, or poor use of the visual equipment.

Although not all eye defects can be changed either by glasses or by orthoptic treatment, any more than any other physical defect can unfailingly be cured or improved, and we must expect some children to fail to learn to read in the real sense anyway, there is too much discrepancy between children's social good sense and poor learning in school. As educators we should be bold enough to start out with the hopeful premise that a child who is old enough, mature enough to be socially intelligent is intelligent enough to learn to read if he can see clearly, and if he can understand the words and thought he is intending to read.

Functional Tests III: Some Effects of the Common Cold on Cardio-respiratory Adjustments to Exercise and Cardio-vascular Test Scores*

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MANY laymen, and athletes particularly, seem to think that a vigorous physical work-out is indicated if they are suffering from a cold; they believe that they can "sweat it out." Medical authorities frown on this practice, since it is believed that it may lower the resistance of the body to secondary invasion and possibly result in serious complications. The uncomplicated cold is not believed serious in itself.[32†] The literature, however, appears to be almost sterile with respect to quantitative evidence concerning the effect of a cold on the physiological adjustments to exercise.

There is some reason to believe that "physical fitness" or "efficiency" is temporarily impaired by a cold; if this is so, it would be expected that cardiovascular test scores would suffer a corresponding impairment, since proponents of the use of these tests are of the opinion that they measure "fitness" or "physical efficiency" (*c.f.* publications by Hunt and co-workers, McCurdy and Larson, Schneider, Scott, Tuttle and co-workers, etc.).

The experiment to be described was undertaken with the intention of casting light on possible physiological impairment caused by the common uncomplicated cold, particularly any effects related to the response to and recovery from exercise. It was hoped that data could be simultaneously secured that would bear on the question of the comparative validity of various cardiovascular tests as measures of physical fitness and health status, since there is confusion in the literature on this point.

Without question the Schneider test [36] (even though set up without the aid of modern statistical methods) has more *independent* validation behind it than any other. McCloy in 1931 set up a new

* Previous publications in this series (Henry and Kleeberger[11], Henry and Farmer[9] have been concerned with the pulse-ratio test. The data of the present study were briefly reported before the Southwest District Convention, Am. Assn. for Health, P. E., and Rec., Long Beach, March 1940.

† Superior figures refer to numbered Bibliography at end of article.

cardiovascular test and compared it with the Schneider test on the same subjects; the Schneider test fell down.[21] McCurdy and Larson, in 1937, compared their cardiovascular test with several others, including one of McCloy's, and found their own to be the only valid one.[26] The writer, in a preliminary report,[10] found indications that the Schneider test might be more valid than either the McCurdy-Larson[25] or Tuttle pulse-ratio[40] tests; it was pointed out in this report that the only link needed to complete this cycle of confusion would be an experimental study showing that the Tuttle test was valid and the McCurdy-Larson test invalid. Unknown to the writer, this link had already been formed through an unpublished thesis by Kuscher[16] of the Springfield College; Kuscher, in sharp disagreement with McCurdy and Larson, found their test invalid ($CR = 1.8$) in differentiating between the conditions of early convalescense and normal health although the Tuttle test gave a statistically significant difference ($CR = 2.8$).

METHODS AND PROCEDURE

Advantage was taken of the enhanced sensitivity and precision of control afforded by the method of paired variates.[39] The same subjects were observed under both normal and experimental (i.e., diseased) conditions. Heart rates were recorded by an apparatus which was operated automatically by the electric action potential of the heart. Electrodes consisting of 40 mm. brass discs were placed on the subject's chest over the electrical axis of the heart. Low resistance contact was insured through the use of a special electrode paste.[15] Wires connected the electrodes to an amplifier which stepped up the heart potential so that it operated an automatic counter,[7] a pen that recorded the individual beats, and an electric integrator that gave a continuous average of the heart rate.[8] This device was particularly suited to the present study as it gave the heart rate during the exercise and the Flarimeter blow * as well as at rest and during the recovery period. A record of the breathing and Flarimeter blows was made by a Sumner pneumograph which operated a pen on the polygraph used in an earlier study.[11] The polygraph tape also recorded time in seconds and the heart beats and rate as described above and in addition carried an automatic record of the beginning and end of each step on the 13-inch stool used for the test exercise. Blood pressures were obtained manually by the auscultatory technique.

When the subject first came to the laboratory, a preliminary

* The Flarimeter[42] is a pressure gauge equipped with a mouthpiece. The subject blows through the gauge at constant pressure, the air being released through a standardized orifice. It is used in the McCurdy-Larson test to measure vital capacity and also to produce a positive intra-thoracic pressure immediately after exercise. This interferes with the circulation by collapsing the great veins. The length of time this interference can be tolerated is one of the test measures.

stool exercise was given, followed by a few practice blows and a vital capacity measurement on the Flarimeter. After a standard rest period, sitting blood pressures were taken, and then the subject resumed resting in the reclining position. Reclining blood pressures were next taken, immediately followed by instrumental recording of the heart rate and breathing on the polygraph. After this, the subject stood vertically, the recording was continued for three minutes, and standing blood pressures were taken. Next, a one-minute exercise was given at the rate of 20 stool-mountings per minute, and recording continued for several minutes thereafter. The subject then reclined for another standard rest period. Following this, reclining and standing measures were repeated, and a one-minute exercise at twice the previous rate was given. After the third rest period, the McCurdy-Larson exercise was given, and followed 20 seconds later by the post-exercise Flarimeter blow. Continuous polygraph records were made as before. Exactly the same procedures were followed when the subjects were retested after a period of about three weeks.

The above procedure made it possible to study the behavior of the heart rate and breathing during change in posture, during adjustment to and recovery from several degrees of exercise, and during and following interference with the circulation by the application of a positive intra-thoracic pressure of 20 mm. of mercury. It also made it possible to calculate scores for the following functional tests: Crampton,[3] Foster,[6] McCloy, [21, 26] McCurdy-Larson,[25] Schneider,[36] and pulse ratio in both the original (English) form [12, 34] and in Tuttle's modification.[40] Obviously, it was also possible to study the separate items making up these tests.

Twenty-one subjects (college students) were tested on the second or third day of the course of an uncomplicated cold, and again about three weeks later. The test had been administered to one-fourth of the subjects in connection with another study before they became infected, so it was possible to balance out possible "practice effects" for approximately half of the series. It has been shown that this control measure is necessary under some conditions.[9]

The Schneider test exercise used in the present study was, of course, somewhat more vigorous than the 5 steps in 15 seconds on an 18-inch stool that is recommended in the standard procedure.[36] There is every reason to believe, however, that this alteration tends to improve the test. It was necessary to extend the scoring tables slightly by extrapolation because of this change, but since the present study is concerned only with differences in the test scores under the experimental and control conditions, the procedure does not invalidate the results. In the case of the Foster test,[6] the scores were calculated with both the 20- and 40-step exercises. For the Tuttle test,[40] standing pulse rates were used.

TABLE I

CRITICAL RATIOS OF THE MEAN DIFFERENCES BETWEEN EXPERIMENTAL AND CONTROL CONDITIONS

The standard deviations of the means have been calculated by the small-sample method, using (n-1) in the denominator, so the critical ratios are equivalent to Fisher's *t*. The per cent values of the differences that are statistically reliable will be found in the text.

Recl. diast. pres.	0.45	Syst. pres.	1.38
Sit. diast. pres.	0.59	Syst. pres.	1.05
Stand. diast. pres.	0.68	Syst. pres.	1.42
Diff. recl. to stand.	0.26	Syst. pres.	0.15
P. rate during Ex. #1	0.19	During #2	0.37
0-15″ after Ex. #1	0.09	After #2	0.81
0-60″ after Ex. #1	0.19	After #2	0.35
60″-120″ after Ex. #1	0.37	After #2	0.12
120″-135″ after Ex. #1	0.11	After #2	0.20
Br. rate before Ex. #1	1.04	Before #2	0.74
0-15″ after Ex. #1	1.58	After #2	2.62
15″-60″ after Ex. #1	0.97	After #2	1.01
60″-120″ after Ex. #1	0.57	After #2	0.43
Pulse ratio Ex. #1	0.75	P. ratio #2	1.20
Foster Ex. #1	1.45	Foster #2	0.06
McCloy 2 items	.47	.....	.....
McCloy 5 items	1.04	.....	.....
Recl. P. pres.	0.37	P. rate	1.53
Sit. P. pres.	.....	P. rate	.....
Stand. P. pres.	0.82	P. rate	0.98
Diff. recl. to stand.	.....	P. rate	1.32
P. rate during #3	0.20	Inhale	2.06
0-15″ after #3	0.46	During blow	1.59
0-60″ after #3	0.34	During dip	2.77
60″-120″ after #3	0.41	End dip	0.80
120″-135″ after #3	0.07	Rebound	0.58
Br. rate before #3	.....	.....	.....
0-15″ after #3	2.47	Av. #2 # 3	3.05
15″-60″ after #3	.....	Vital cap.	0.87
60″-120″ after #3	.....	.....	.....
Tuttle (a)	2.40	Crampton	0.45
Mc.-L. (b)	0.95	Schneider	0.09
Mc.-L. (c)	1.43	Schneider (d)	0.38
.....	.....	Schneider (e)	0.58

NOTE: Tuttle (*a*) is the critical ratio for the step-score test; Mc.-L. (*b*) the ratio for the complete McCurdy-Larson; (*c*) is the ratio for the single item "standing pulse rate minus rate 2 minutes after exercise"; Schneider (*d*) is the ratio for the single item "rate increase immediately after exercise" and (*e*) for the item "return of pulse to standing normal." All other test items appear in the table under individual descriptions.

EXPERIMENTAL RESULTS

The critical ratios of the differences in test scores between experimental and control conditions are shown in Table I. Undoubtedly all ratios of 1.59 or below are not significant, and all of 2.40 or above are significant according to modern statistical interpretation.[33, 39] There is one critical ratio of 2.06 (yielding a probability

of 97.5 chances in 100), a possible borderline case that is not important in terms of the general trend of the data.

The only significant single test item is length of Flarimeter blow after exercise, with a decrement of 18.1 per cent. The only significant total test score is pulse-ratio steps,* with a decrement of 14.5 per cent.

Of the circulatory measures not used in calculating functional test scores, the only significant change is in the behavior of the pulse rate during the Flarimeter blow. Immediately after exercise, the pulse rate of the experimental group† was slightly but not significantly higher than the controls, but dropped to 4 per cent below the controls as a result of the cardio-inhibiting effect of taking a large breath of air that was inhaled in preparation for the Flarimeter blow. This change is not as reliable statistically as the others ($CR = 2.06$); on the other hand, it certainly does not support a null hypothesis very effectively.

Seven seconds after the start of the blow, the pulse rate was still slightly lower, but had become higher at the termination of the blow. During the post-blow cardio-inhibited phase, the pulse rate of the experimental group dropped about 6 per cent below the controls. This last difference is statistically reliable. The rebound showed no significant differences.

The breathing rate was not significantly altered at rest or during recovery from the 20-step exercise, but was 12 per cent higher in the experimental group during the first 15 seconds of recovery from the 40-step exercise, and 9 per cent higher during the same period following the McCurdy-Larson exercise. (This exercise was roughly equivalent to the 40-step exercise in severity.) Both these differences are statistically reliable. Significant differences in breathing were not present during later stages of recovery. Owing to the tendency of the subjects to synchronize their breathing with the stool-stepping, it was not considered advisable to measure the breathing rate while the subject was actually exercising. It is quite possible that significant differences in ventilation may have been present at that time.

*In Tuttle's modification of the pulse-ratio test,[40] the ratio of the two-minute post-exercise pulse count to the one-minute pre-exercise count is scored for both an easy and a hard exercise. Each exercise lasts one minute; typical rates are 20 and 40 mountings of a 13-inch stool. Each mounting is called a *"step."* By linear interpolation, the *"step-score"* is calculated as the number of steps that would have been required to produce a pulse ratio of 2.50. In the Miller-Tuttle modification,[20] which will be discussed later, a third exercise using the calculated step-score is given, and scored by taking the arithmetic difference between the pulse ratio obtained from this exercise and the theoretical 2.50 pulse ratio. This score is called the *departure from linearity*. In practice the *departure from linearity* is frequently calculated from reference pulse ratios that differ from 2.50.

† The nomenclature *experimental group* and *control group* will be used for reasons of convenience. Identically the same individuals made up both groups. They were tested under *experimental* conditions when suffering from a cold, and under *control* conditions when they were normal.

In the sub-group that consisted of the individuals who had been tested under control conditions before they became infected, the average amount of the difference was about the same in the sub-group and the total group for the measures that showed a statistically reliable differentiation between the total groups. This was not tested in the case of non-differentiating measures.

The most striking difference between the experimental and control groups is undoubtedly the 18 per cent decrement in the post-exercise Flarimeter blow. This decrement is remarkably consistent, being present for 20 of the 21 subjects. In order to aid in interpreting this result, a supplementary experiment was performed on a new group of 16 normal individuals. When these subjects made a maximal blow after exercise, the last 30 c.c. of expired air that passed through the Flarimeter was collected and tested with a modified Haldane gas analyzer. The average CO_2 content was 7.49 volumes per cent, and the O_2 was 11.8 volumes per cent.

The length of the post-exercise blow is found to be correlated to the extent of $r = .72$ with CO_2 and $-.91$ with O_2. The intercorrelation between CO^2 and O_2 is $-.73$. When the CO_2 content is partialled out, the correlation between length of blow and O_2 is $-.80$, but when O_2 content is partialled out, the correlation between length of blow and CO_2 content drops to .22. The correlation between O_2 and CO^2 drops to $-.22$ when length of blow is partialled out. These last coefficients are not reliably different from zero, but all the others are statistically significant.[33] Naturally the exact magnitude of the true correlations are not very precisely determined by this experiment since the number of cases was small, but the trend seems clear enough and that is the important point here.

DISCUSSION OF EXPERIMENTAL RESULTS

The physiological differences between the experimental and control conditions can be explained by the hypothesis that concomitant with the infection there was present a condition of compensated reduction in alkaline reserve. This resulted in no alteration of the measured cardio-respiratory functions at rest, but caused an increased post-exercise acidosis. This condition was not extensive enough to alter the simple post-exercise pulse counts, but was revealed by the Tuttle modification of the pulse-ratio test, and by the hyperventilation during the first stages of recovery following the more vigorous degrees of exercise. The increased ventilation was superimposed on the normal post-exercise hypernea, and occurred at a time when acid metabolites were near the maximum. The shortened post-exercise Flarimeter blow is consistent with this hypothesis. It is true that during rest, compensatory hyperventilation due to CO_2 stimulation is known to be typically revealed by increase in depth of breathing rather than rate, but the dynamics are altered during

exercise and very small changes in CO_2 produce large changes in rate.[5]

All the factors operative in causing the termination of the Flarimeter blow are not fully understood.[42] The subject still has considerable air in his lungs at the end of the post-exercise blow, and inspection of the breathing records of the present experiment shows that this air is exhaled before new air is brought into the lungs. It is known that positive intrathoracic pressure results in a marked interference with venous return to the heart. Concurrently there are considerable alterations in both pulse rate and blood pressure. Undeniably, however, the overpowering stimuli from the cardiorespiratory centers that eventually result in termination of the blow are conditioned to an important extent by alterations in the chemical reaction of the blood. This follows from the fact that the positive intrathoracic pressure toleration time compared with resting conditions is only one-third or one-fourth as long when the blow is immediately preceded by the quantity of exercise used in the present experiment.

Since the blood is in approximate gaseous equilibrium with the alveolar air, analysis of this air reveals something concerning the amount of O_2 and CO^2 in the blood. The terminal sample of air from the Flarimeter is not of course true alveolar air, but its content of these gases is undoubtedly influenced by the composition of the alveolar air. Under these assumptions, it is possible to make an interpretation of the correlations reported above between the length of blow and the CO_2 and O^2 content of the terminal Flarimeter air. Now, if the concentration of CO_2 is an important determiner of the length of the blow, and if there were no individual differences in the amount of accumulation of CO^2 that could just be tolerated, there would be a correlation of zero between length of blow and extent of CO_2 accumulation (because the correlation between a variable and a constant is always zero). The same argument holds for O_2 concentration, but in this case the toleration level would be determined by depletion rather than accumulation. It must be kept in mind, however, that there are probably individual differences in toleration level. Another important point to be considered is the fact that length of blow, as such, will influence the amount of accumulation or depletion. In other words, if a given individual made blows of varying length, it is obvious that the length of the blow would correlate positively with the CO_2 content of the Flarimeter air, and negatively with the O_2 content.

In the supplementary experiment it was found that the zero-order correlation between length of blow and O_2 depletion was .91, and between length of blow and CO_2 accumulation was .73. Some insight into the meaning of these correlations when individual dif-

ferences are taken into consideration may be gained by considering the partial coefficients. When the variance due to O_2 is partialled out, the correlation between length of blow and CO_2 concentration is not statistically different from zero (.22), although when the variance due to CO_2 concentration is partialled out, the correlation between length of blow and O_2 depletion is still high (.80). This means that in a theoretical group of subjects who blow as long as possible under post-exercise conditions, no correlation would be expected to appear between length of blow and CO_2 accumulation among the individuals who have the same degree of O_2 depletion, while a significant correlation would be expected between length of blow and O_2 depletion among individuals who have the same degree of CO_2 accumulation. This indicates that CO_2 accumulation is the significant factor in determining the length of blow when individual differences are taken into account, while length of blow, as such, determines the extent of O_2 depletion. Thus it appears that lowered CO_2 tolerance under post-exercise conditions is indicated by the reduced length of blow found for the experimental group. This lowered tolerance would be accounted for, according to the hypothesis, by a compensated reduction in alkaline reserve in the experimental group as compared with the controls. It is regrettable that it was not possible to test this hypothesis directly by blood chemistry determination.

CRITICAL DISCUSSION OF CARDIOVASCULAR TESTS

Failure to find significant differences in functional test scores (except for the Tuttle pulse-ratio test) does not necessarily imply, of course, that these tests are without value. It should be kept in mind that the subjects in the present experiment were not very ill. They had simple cold only. With more severe illness, more extensive differences in test scores might have appeared. Nevertheless, it appears possible to arrive at some conclusions concerning the relative discriminating power of the tests, since at least one of them discriminated effectively. The negative results for the McCurdy-Larson test and positive results for the Tuttle test are in agreement with the conclusions of Kuscher's unpublished thesis,[16] although Kuscher's experimental subjects were convalescing from more serious illnesses rather than suffering from the active stage of the common cold. Kuscher used the fundamental technique of the present study, that is, he studied changes in the same individuals under experimental and control conditions. Schneider has also used this technique. McCurdy and Larson [24*] published a series of scores ob-

* McCurdy and Larson did not calculate the critical ratio. The writer has done so, and finds it to be 2.9. However, their contention that test scores are improved by "training" is *not* proved by this series of cases, since the critical ratio in this case is only 1.5.

tained on their test by this technique, comparing infirmary-convalescent subjects against the same subjects under normal conditions. The differences are statistically significant. These subjects were very likely suffering from more severe illnesses than those of the present study. But remember that Kuscher's study at the same institution gave negative results for their test under similar conditions. It is therefore necessary to conclude that the Tuttle pulse-ratio test is more effective than the McCurdy-Larson.

The Tuttle and Dickinson [41] simplified pulse-ratio test failed to differentiate in the present study, although the pulse-ratio step scores were effective in doing so. Now this simplified test is substantially identical with the original Hunt pulse-ratio test developed by the Guy's Hospital group.[34] Tuttle and Dickinson's case for the validity of this simplified test rests on their finding of a high rank order correlation between it and step-scores. Balanced against this is the fact that the Guy's Hospital group eventually favored discarding the ratio test. For example, Campbell[1] states that rapid pulse rate at rest is a sign of unfitness, but makes the subject *more* efficient as judged by his pulse ratio. * Hunt also was aware of this difficulty. On the other hand, Tuttle's step-scores based on two degrees of exercise seem to be effective. In addition to the results of the present study, the writer has secured other (unpublished) data which indicate that the step-score test differentiates between criterion groups while the simplified test does not.

While on the subject of the pulse-ratio test, it seems appropriate to comment on the use of Miller and Tuttle's modification of the test for the purpose of discovering uncompensated heart lesions.[29] The criterion of normality has been taken as the linearity of increase in ratio with respect to increased steps per minute in stool-climbing exercises of constant duration. The criterion of abnormality has been taken as the difference between the estimated pulse ratio (assuming linearity) for an intermediate exercise and the pulse ratio actually obtained for the exercise, the linear curve having been established previously by an easy and hard exercise. No attempt has been made to establish the nature of the non-linear function. If there is such a function, the differences between experimental and calculated values would obviously depend upon the point of departure from linearity, also upon the degree of exercise. Yet there has been

* The uncertain validity of the simplified test needs to be emphasized because a recent textbook on tests and measurements[23] makes a statement to the effect that Tuttle and Dickinson have shown the pulse-ratio score obtained for thirty steps is as adequate a measure of condition as the number of steps necessary to obtain a 2.5 ratio. Also Larson and Cox[17] have recommended this test for use in the field without a critical examination of the evidence for its validity. But Tuttle and Dickinson concluded merely that the simplified test was as reliable as the step-score test, although they do imply in the body of their article that it is also valid for rating " . . . physical efficiency, endurance, and present condition."[41]

no standardization. Sievers,[38] for example, used intermediate exercises ranging from 20 to 40 steps, a total range of exercise of 12 to 50 steps, and calculated pulse ratios ranging from 2.22 to 3.12. From a geometrical point of view, no significance can be attached to the numerical values of the departure from linearity obtained under such conditions. Yet Sievers, and also Lee,[18] obtained results as valid as those of Carpenter [2] who held to a calculated pulse ratio of 2.5. Another disturbing point is the fact that the amount of work done in climbing a stool is not by any means a linear function of the steps per minute over the range of 12 to 50 steps per minute, or even a lesser range. No elaborate experimental study is necessary to prove this statement—the reader needs only to climb a 13-inch stool at these rates in order to be convinced.

The writer proposes the discarding of Tuttle's "linear-non-linear" theory for this use of the test. Instead, a theory is proposed to the effect that the pulse ratio of the uncompensated heart lesion case is unstable, and that such a heart simply behaves erratically (insofar as rate is concerned) when called upon to adjust to exercises of the magnitude used in the intermediate and hard exercises of the pulse ratio test. This hypothesis is supported by the fact that, as the writer has shown elsewhere,[9] the test-retest reliability of pulse ratio step-scores is zero for abnormal hearts. According to this theory, the proper way to apply the test would be to start with an easy exercise, and follow it with progressively harder exercises until the post-exercise count (or the pulse-ratio) behaved erratically in terms of the predicted rate. There is nothing new in this procedure (see, for example, the Guy's Hospital studies, also Master [19, 20]), which was originally developed in order to avoid such experimental procedures as giving a 50-step-per-minute exercise to an individual suspected or known to have an uncompensated organic heart lesion.

Now, turning to possible explanations for the lack of agreement in the literature as to the relative validity of the various functional tests, a number of possibilities are apparent. Several suggestions have been made to the writer, one being to the effect that the different tests measure different aspects of "physical fitness." (See also McCloy.[23]) This is possible, of course, but it is certainly true that considering the entire range of factors that can be postulated as important in "fitness," the cardiovascular tests all appear to sample about the same area. Within this area some minor differences may be found, but they appear to be small. McCloy [22] and Murphy [30] have made factor analyses of cardiovascular test items, and have concluded in effect that factors are present that are concerned with the control of the various circulatory processes when the body is reclining, standing, and recovering from exercise. The converse approach, namely an inverted factor analysis, has not yet been made

and it may be that it would yield an answer to the fundamental question.

Another suggestion has been to the effect that some of the tests, having been set up and validated on the basis of inter-group differences, could not be expected to be sensitive to intra-individual changes in condition. Other tests, being developed from intra-individual observations, could not be expected to differentiate between individuals or groups. This position is untenable, since for example the Schneider test, primarily validated originally through the intra-individual technique ("staleness" in aviators, for example), is quite effective in differentiating groups.[28] Tuttle's test, validated by comparing inter-individual differences primarily,[40] has been shown both by Kuscher [16] and by the present study to be sensitive to intra-individual changes. The McCurdy-Larson test, developed and validated by the inter-group method, was shown by them to be sensitive to intra-individual changes.[24]

It is the writer's opinion that the reason for the unsettled status of the cardiovascular tests revealed by the literature may be explained in simpler terms. Judging from this literature, the three most important cardiovascular tests are the McCurdy-Larson, the Tuttle pulse ratio, and the Schneider. Research indicating high validity for the first of these has apparently been confined to the Springfield College group. The validity coefficients reported by them * cannot in general be accepted at their face value, because they are based on the application of the biserial correlations technique to a mutilated distribution in the dichatomous criterion variable.

If a high correlation is postulated between the criterion variable and test scores, it follows directly that the Y distribution is also correspondingly mutilated. The writer has gone over McCurdy and Larson's fundamental statistical reference, which is a brief note by Richardson and Stalnaker,[35] and finds that the biserial correlation they use was developed for the special case of item analysis where $X^2=1$ and $X_1=0$. It is not clear how the fitting of the McCurdy-Larson criterion variables into these categories can be justified. Furthermore, this formula assumes that the Y distribution is unmutilated and its standard deviation comparable to that of a *random* sample of the total population just as is assumed in the ordinary biserial formula. As Peters and Van Voorhis point out [33] (p. 365), there is considerable temptation to use extreme groups in the dichatomy, but this gives a correlation that is much too high. They give a formula for use with widespread dichotomies, (p. 384 *ff.*) but unfortunately it assumes a normal distribution in both variables and sharp truncation due to the mutilation.

* Larson has accepted the responsibility for the statistical work. See McCurdy and Larson,[24] page 12.

Now this departure from orthodox statistical methodology does not necessarily imply that the validity coefficients so obtained are meaningless, but it certainly does mean that their numerical values cannot be interpreted by conventional standards. Some significant coefficients have been obtained by standard methods (for example, see Cureton [4]) but Kuscher [16] obtained negative results under conditions when the test would be expected to differentiate, as likewise did Olds,[31] working independently. Clearly there is a need for other independent studies of this test. It may be that some unknown uncontrolled factor is involved, or it may be that the statistical methods used have been inadequate. In the reviewer's opinion, the more recent approach to the problem made by McCurdy and Larson [27] using orthodox statistical methods will be more easily confirmed than the earlier work, even though it may indicate that considerable reweighting of the test items is necessary.*

Similarly the evidence for the validity of the Tuttle tests is largely the product of the Iowa research group who originated the test. Kuscher,[16] working independently, also Henry and Kleeberger,[11] have reported evidence for its validity, although in the latter case certain reservations were noted. The positive results obtained by Carpenter [2] on the Miller-Tuttle modification are inconclusive because no control was instituted. The present study also yields positive results for the validity of the Tuttle pulse ratio test, both as to the test itself and as to its comparative validity. This latter result is also in agreement with Kuscher. A preliminary study by Henry and Herbig [10] has indicated that the Schneider test may be more effective than Tuttle's test and certain others in predicting changes in athletic condition, but this result has not yet been confirmed and should not be taken very seriously. If confirmed, it would lend support to McCloy's hypothesis [23] (p. 236) of the four purposes of cardiovascular tests, namely, the measurement of functional health, athletic condition, general physical condition, and condition of the heart. The writer is a firm believer in the efficacy of the multiple regression technique for test construction, but the only possible conclusion at present is that the Tuttle test (which was developed without statistical weighing methods) is most effective on a comparative basis.

Except for the preliminary study mentioned above and the present study, the Schneider test does not seem to have been evaluated with respect to the other two under comparable conditions. McCloy [21] compared the predictive power of Schneider scores with

* The present experiment (also that of Kuscher) used the second (Dec. 1935) form of the McCurdy-Larson test.[25] The third (1940) form,[27] mentioned above, is considerably different, and is based entirely on static blood pressure measurements and length of Flarimeter blow. Tuttle's test is based entirely on pulse rate. McCloy[23] (p. 250) has also cast doubt on the validity of the McCurdy-Larson test.

that of his own test and found it to be inferior, but this was not a fair comparison since the multiple correlation of test items with the criterion is known to be higher than the test-criterion correlation obtained on data that is independent of that used in originally deriving the regression coefficients. A considerable amount of independent validation using quite dissimilar criteria, is available for the Schneider test.* The study of McFarland and Huddleson [28] is a good example of the more recent work, and that of Scott [37] is typical of the earlier work. The test is more widely used than any other at the present time in the physical examination of prospective aviation pilots.

Both the present study and McCloy's [21] investigation are in agreement in showing the low validity of the Crampton and Foster tests on a comparative basis. There is also agreement with McCurdy and Larson [26] as to low validity for the McCloy two-item test.

In summarizing this critical discussion, several important facts emerge. For the three principal tests, the criteria of validity have been about the same, namely, different test scores obtained when subjects differed in athletic condition, general physical condition, and health status. The McCurdy-Larson test has also been validated in terms of endurance in swimming [4] and the Tuttle test in terms of endurance in running [11] (the physiological bases of endurance are, of course, common to both). Inspection of the literature reveals an absence of cross-references, and an absence of comparative evaluation (since Kuscher's study [16] is unpublished). The McCurdy-Larson test may be designated a blood-pressure-respiratory test involving (in its latest form) exercise tolerance in terms of length of Flarimeter blow alone. In contrast, Tuttle's test is frankly an exercise tolerance test, tolerance being measured by pulse-rate alone. It is at present only possible to make a tentative evaluation of the validity of either test, since neither has been subjected, to any considerable extent, to the commonly accepted scientific criterion of independent verification. Comparative evidence, which is not extensive as yet, indicates that the Tuttle test is the more effective of the two. Schneider's test, which has been subjected to considerable independent verification, involves heart rate, blood pressure, and exercise tolerance. Its comparative validity is largely undetermined, but the present experimental study has indicated that it is less effective than the Tuttle test. It is clearly apparent that there is a need for independent verification of the first two tests, and for additional comparative studies concerned with all three.

The present study seems to justify further investigation of the

* This point was discussed in some detail in a paper presented by the writer before the Administrative Measurements Section of the A.A.H.P.E.R. Convention, San Francisco, April 1939.

validity of the breathing rate immediately following exercise as a possible item in a functional test battery. In the absence of recording equipment, it ought to be possible to time the period required for the first five or six breaths, for example, with a fair degree of accuracy. The reliability has been found by the writer (unpublished) to be between $r = .80$ and .90 for instrumentally recorded one-minute samplings. Combining the Flarimeter blow with the Tuttle test also appears to have attractive possibilities, since the intercorrelation seems to be low.

SUMMARY AND CONCLUSIONS

A series of twenty-one subjects were tested while suffering from the active stages of the common cold, and also under conditions of health. The test battery permitted calculation of scores for the Crampton, Foster, McCloy, McCurdy-Larson, Schneider, simplified pulse ratio, and Tuttle tests, and also included a number of physiological items not used in these tests. Blood pressures were taken manually and the other items recorded automatically by suitable instruments. In a supplementary experiment, samples of terminal Flarimeter air were analyzed for O_2 and CO_2 content.

During the active infection, the mean length of Flarimeter blow after exercise was shortened 18.1 per cent and the pulse rate was reduced 4 per cent at the start of the blow and 6 per cent at the end of the blow. At other times the pulse rate was higher, but not significantly so. Termination of the Flarimeter blow was found to be conditioned by the tolerance level for CO_2 accumulation rather than O_2 depletion. Hyperpnea during recovery from a brisk exercise (as measured by breathing rate) was increased 10.5 per cent, but was not significantly increased for a mild exercise. Exercise tolerance as measured by Tuttle's test showed a decrement of 14.5 per cent. Other cardiovascular tests and physiological measures yielded negative results. The results are explainable on the hypothesis that a compensated reduction in alkali reserve had occurred. The relative decrements in cardiovascular test scores are in agreement with the results reported by Kuscher for convalescence, with McCloy's report of low validity for the Crampton and Foster tests, and McCurdy and Larson's report of low validity for the McCloy two-item test.

A critical analysis of the literature on the cardiovascular tests used, in relation to experimental results, leads to the conclusion that there is definite need for additional confirmatory and comparative studies of the McCurdy-Larson and Tuttle tests. The Schneider test has had considerable independent verification. An attack is made on Tuttle's theory of departure from linearity as an explanation of the results that have been secured with the Miller-Tuttle test for un-

compensated heart lesions. A substitute theory, postulating erratic behavior of the heart, is proposed. The possibility of incorporating breathing-rate measures in a functional test battery is pointed out.

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The Relative Effectiveness of Two Types of Frog Kick Used in Swimming the Breast Stroke

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TODAY there are a number of types of kicks advocated for use in the breast stroke. The purpose of this study was to examine objectively the relative effectiveness in terms of force, speed, and economy of movement of two of the types of frog kick used in swimming the conventional breast stroke.

The two kicks which were chosen are referred to as the "wedge" action and the "semicircular arc whipping" action, since the greater part of the drive of the kicks in propelling the body through the water comes from leg actions which describe those movements.

The major differences in the leg action are in both the recovery and the kicking phases. The recovery for the "wedge" is made by pointing the knees lateralward as they flex, and keeping the heels together. The propulsive force is gained by pushing the feet outward and backward, and then driving the wedge of water out from between the extended legs. The action takes place in the same plane as nearly as possible.

The recovery for the "semicircular arc whipping" action kick is made with only slight flexion at the hips, both knees and feet are apart, and the knees flex so that the feet are brought upward but below the surface of the water. The legs are then whipped outward and around in a "semicircular arc."

Two approaches were made to the problem:

1. Through a group of eleven experienced swimmers who had presumably mastered both types of kick. These were college women of faculty or graduate student status.

2. Through two college classes of inexperienced swimmers, to each of which class a different kick was taught. There were nineteen in one class and twenty in the other whose data were used.

The two groups will be discussed separately.

This paper is an abstract of a master's thesis, Wellesley College, 1941.

EXPERIENCED SWIMMERS

To measure the force of the kicks in pounds, an adaptation of the dynamometer devised by Karpovich was used. The base of this apparatus was constructed of 2″ x 4″ boards which were put together in such a way as to fit securely over the edge of the pool and down to just below the water. A spring balance scale with a sliding indicator was fastened on the top of the base, and a rope was hooked to the scale. This rope was run over two small wheels down to the water's edge, and the end hooked to the back of the subject's belt. A second rope from the other end of the pool was attached to the front of the swimmer's belt, the object being to keep the subject from moving backward during the recovery part of the kick. As the subject kicked, her body moved forward in the water and the force of the kick was recorded on the scale.

When force for kicks alone was measured, each subject held a water polo ball at extended arms' length for the support of her upper trunk and arms.

No data were taken on any subject until, in the opinion of the faculty member in charge of swimming and the investigator, they were able to use both kicks with approximately the same degree of skill. Data were taken for force in pounds as measured on the dynamometer, and for the number of kicks and the time consumed in swimming the length of a 75-foot pool.

In each instance, the element was measured for the "wedge" action kick alone, for the full breast stroke using the "wedge" action kick, for the "semicircular arc whipping" action kick alone, and for the full breast stroke using the "semicircular arc whipping" action kick.

The data for each of the measurements for force were gathered on four separate days. Those for the number of kicks and the time were gathered on two different days.

The mean force when the "wedge" kick was used alone was 28.00 pounds; "wedge" kick and arms, 29.25; "circular whip" kick alone, 30.93; and "circular whip" kick and arms, 30.75.

The mean number of kicks when the "wedge" kick was used alone was 19.8182; "wedge" kick and arms, 13.8182; "circular whip" kick alone, 18.5000; and "circular whip" and arms, 12.2727.

The mean time when the "wedge" kick was used alone was 46.5455; "wedge" kick and arms, 37.1136; "circular whip" kick alone, 43.2091, and "circular whip" kick and arms, 35.2045.

The analysis of variance method was used in calculating for the significances of the differences. For experienced swimmers, the "semicircular arc whipping" action kick develops a significantly greater amount of force, it uses fewer kicks to cover a given distance, and it propels the body through the water more rapidly than the "wedge" action kick.

INEXPERIENCED SWIMMERS

One class of inexperienced swimmers was taught the "wedge" action and the other class, the "semicircular arc whipping" action kick. After the equivalent of four class lessons on the breast stroke, data

DATA FOR EXPERIENCED SWIMMERS

Subjects	"Wedge"	Full Stroke with "Wedge"	"Circular Whip"	Full Stroke with "Whip"
	Force (in pounds)—mean of four trials			
1.	34.00	30.75	34.25	30.50
2.	32.00	35.50	33.25	34.75
3.	31.25	34.75	40.75	39.00
4.	26.25	25.00	30.75	31.75
5.	26.25	28.75	30.50	31.50
6.	25.00	30.75	30.00	31.00
7.	15.50	19.25	26.00	26.00
8.	34.00	35.00	31.50	34.00
9.	28.00	26.00	26.25	24.75
10.	25.50	24.75	25.25	25.25
11.	30.25	31.25	31.75	29.75
Mean	28.00	29.25	30.9318	30.75
	Number of Kicks—mean of two trials			
1.	13.5	12.0	14.5	11.0
2.	15.5	12.0	16.0	11.0
3.	19.5	14.0	18.0	12.5
4.	19.0	13.0	18.5	11.0
5.	21.5	13.0	19.5	9.5
6.	19.0	13.5	18.0	12.5
7.	25.5	15.5	18.5	13.5
8.	31.0	21.0	30.5	19.0
9.	17.5	13.0	15.5	12.5
10.	21.0	14.0	19.5	12.5
11.	15.0	11.0	15.0	10.5
Mean	19.8182	13.8182	18.5000	12.2727
	Time (in seconds)—mean of two trials			
1.	41.65	34.70	38.30	34.95
2.	37.25	31.95	35.60	29.45
3.	38.45	30.25	32.55	27.70
4.	50.00	36.90	37.90	35.35
5.	47.70	43.25	45.05	43.20
6.	46.75	39.50	43.70	35.50
7.	54.15	36.80	38.90	28.95
8.	47.30	38.20	59.20	38.00
9.	50.25	42.85	51.35	40.70
10.	45.75	33.20	46.05	36.25
11.	52.75	40.65	46.70	37.20
Mean	46.5455	37.1136	43.2091	35.2045

DATA FOR INEXPERIENCED SWIMMERS

	Number of Kicks		Time (in seconds)	
Kick	Mean	S.D.	Mean	S.D.
"Wedge"	26.95	4.98	64.23	15.95
"Circular whip"	26.70	9.75	71.26	23.65
Difference	.25		7.03	

were taken for each of the thirty-nine members for the number of kicks and the time consumed in swimming one length of the pool.

The difference in the mean number of kicks was only one-fourth of a kick better for the "wedge" than for the "circular whip." According to the T test, this difference is not significant. The F test shows that the difference in the standard deviations is not significant.

Although there were 7.03 seconds less mean time consumed by the "wedge" action kick, the T test shows that this difference is not significant. According to the F test, the difference between the standard deviations is not significant.

For inexperienced swimmers with a given amount of instruction, no significant differences appear between the two types of kicks in either the number of kicks or the time consumed in swimming a given distance.

SUMMARY

From the evidence available in this study, it would seem that if only one type of kick is to be taught, the "semicircular arc whipping" action kick would be preferable since:

1. When the two kicks are mastered, it is superior in force, speed, and economy of movement to the "wedge" action kick.

2. From the present study, there is no available evidence that the "semicircular arc whipping" action kick is more difficult to learn.

A Simple Objective and Reliable Measure of Flexibility

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THE need for a simple, objective, and reliable method or means for measuring the ranges of movement of anatomical segments has been recognized and pointed out by many people working in the field of physical education. It is particularly felt by those engaged in the corrective activities field, but a wide range of needed research is held back by the lack of such a system of measurement. When one is available, it will be possible to explore an area of physical status which has been practically untouched to date; norms for the various segmental movements can be established; it will be possible to measure the effect of different types and amounts of exercise upon the range of various segmental movements; natural and unnatural variability can be studied; corrective activities can be validated; and much valuable information can be collected concerning skills and abilities and training problems of the different sports and activities. At present one finds little record in extant literature of systematic study and research dealing with these matters of the effect of various types of exercise upon the freedom of movement of different anatomical segments, upon the relation of body build and muscular structure to flexibility, upon the effect of injury, the effect of age, and other factors which modify the functions of natural movement performed by the body. One can find considerable expression of opinion concerning these matters, but that opinion is for the most part unsupported by strong experimental evidence.

Cureton[2]* has summarized the experimental work done in this field to date in the SUPPLEMENT TO THE RESEARCH QUARTERLY for May, 1941; therefore, only enough description of the existing measuring devices and systems of measurements need be given here to characterize the main types.

Cureton has devised four tests of flexibility which he called Trunk Flexion, Trunk Extension, Shoulder Elevation, and Ankle Flexibility. He used a linear system of measurement using the sliding caliper for the first three measurements and for the fourth (range of ankle movement) a device by which he measured the distance between two marks made on a piece of paper representing the flexed and extended positions of the foot. Cureton standardized his test

* Superior figures refer to numbered Bibliography at end of article.

on cases ranging in number from 551 to 707 and established percentile rankings.

A fundamental criticism may be made in consideration of linear measurements in this field (unless some ratio or index is used) as valid measures of ranges of motion. Consider the diagram (Fig. I) to represent a movement made by two subjects, the ranges of which are to be measured. Let hypotenuse $A\ B'$ represent the body segment of a short man and hypotenuse $A\ C'$ represent the body segment of a tall man. Then it will be seen that if the two segments $A\ B$ and $B\ C$ are moved around the point of rotation A (joint) to a position $A\ B'$ or $A\ C'$ the distance d will be less (as measured with a caliper) than distance d'. It will be noted that angle a is the same for both segments. In general, tall men will have longer seg-

FIGURE I

ments than will shorter men and men of approximately the same height will be found to vary in lengths of individual segments. Therefore, longer segments moving through the same arc (range of motion) would give greater linear measurements (caliper measurements). However, the arcs formed (angular measurement) by longer body segments from their starting positions might actually be equal to, greater than, or less than those of shorter segments. Cureton points out, however, that further research should hold out or equalize this and other body build factors.

Hawley[3] describes a device, which she called a spinal fleximeter, and its use for dealing with postural defects. This instrument is judged to have rather restricted application to special instances of flexibility. These are the sideward bend and the forward and backward flexion of the spine on upper trunk. These measurements are taken with a modified protractor (fleximeter) and are measured in degrees. This instrument is reported to be quite accurate in its application.

McKenzie[5] reported a variety of measures of flexibility for the movements of the shoulder, elbow, knee, ankle, and fingers. In general, each movement required a different apparatus or instrument for its measurement. These measures apparently were designed primarily for purposes of diagnostic and remedial exercise. No norms were reported.

Benson [1] measured the flexion and extension of the knee and ankle joints and also the abduction of the shoulder joint with a special apparatus which was essentially a 360° protractor. The measurements were taken on injured joints before and after treatment and the results recorded for the purpose of noting improvement. It was reported by Benson to be a very reliable measurement. No account was found of the use of this instrument, however, to determine normal ranges of motion nor of its adaptation to a more comprehensive system of measurement of movements.

These and other known devices for the most part permit only specialized application to certain movements. Their usefulness for research has been limited for several reasons: because of this specialization of application, because most of them are complicated and consume considerable time in taking the measurements for which they have been developed, because their use involves measurement in non-comparable units. Two still more fundamental weaknesses limit the value of these devices. With most of them, variation in length and other structural peculiarities of the same anatomical segments for different people have affected the numerical values in the data obtained, and, lastly, no systematic proof of the reliability of these measuring devices has been shown. It is the purpose of this paper to present the result of the writer's experimentation with the measurement of flexibility as defined above and to submit a device and method for its measurement.

The writer first attacked the problem by inspectional study of the range of movements made by different parts of the body in the performance of their natural functions, that is, through observation of muscular movements controlled by the subject. This involved study of what was considered to be an optimum shortening of the particular muscle group involved in the movement with consequent lengthening of the antagonistic muscles. Logically, it appeared that skeletal structure limited the range of movement in some cases and not in others; that in some cases the muscles tended to limit the freedom of body movements when they had been limited in function by the nature of their use and development.

The second step was a study of available devices and methods described above as used in measuring flexibility, and attempted experimental application of these methods and devices to recognized segmental movements. In following out these two steps, it soon became evident that the desired method and instrument should, if possible, meet certain requirements. These are listed as follows:

1. The method should involve measurements taken in units universal to all movements.

2. The instrument and method should be free from the effects of any variation in length in body segments.

3. The instrument should not be dependent upon conformity to the segmental structure itself. It must be applicable to measurement of all segments, such as ankle movements, elbow movements, neck movements, etc.

To sum up, it seemed essential that the instrument be one which could be applied at any or several points on a moving segment; or, one which could be applied readily at some arbitrarily chosen point on any segment. Further, the objective units of measurements were studied, resulting in the final rejection of all except angular measurements—arcs of segmental movements to be measured in degrees. The instrument described later was devised to meet all these requirements and assumptions. The measures obtained with the instrument were studied as measures of the normal range of motion around joints and considered to be flexibility as defined in this study. The measurements were taken by attaching the instrument to the parts of the body to be measured and observing the arcs through which the different segments could be voluntarily moved. Readings were made directly from the instrument and recorded in degrees of deviation from a standardized starting position in each movement.*

THE INSTRUMENT

The first instrument devised for the measurement was a flat circular dial, 4½ inches in diameter and marked off in degrees

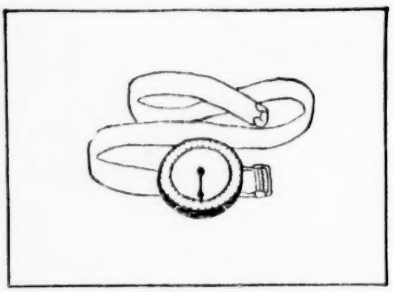

FIGURE II

(360°). To the center of this dial was attached a weighted needle which always pointed downward, perpendicular to the floor, when the dial was held on edge. This is the only position in which the dial may be used as it is the only position in which the needle will register. On the back of the instrument is fastened a strap. This in turn was fastened around a portion of the subject's body depending on the measurement to be taken. An idea of the construction of the instrument will be gained from the drawing (Fig. II).

* The writer carried out this study with guidance and aid from Wayne W. Massey, Ph.D., Assistant Professor of Physical Education, University of Oregon.

Further development of the instrument resulted in one with a weighted dial and weighted needle. When placed in the starting position for the movement to be measured, the dial immediately comes to rest with the zero uppermost. The weighted needle comes to rest with the point resting on zero. The dial is locked in this position and the movement is then performed to its extreme limit, where the needle is locked in position. The direct reading of the needle on the dial is the arc through which the movement took place. The posts on the instrument contain the locking devices. This instrument is much easier to use, is much more accurate, and saves considerable time over the use of the first instrument. Also, it is not affected by minor tilting in the process of movement because the moving parts are nicely balanced on ball bearings.

The mechanics of the apparatus is based upon the fact that gravity always pulls the weighted end of the needle downward during the execution of the movement. Its validity as a device to measure flexibility of ranges of motion is based upon the condition that most of the bending done by an individual during a particular movement is assumed to take place around the joint or joints of the segments; this movement is the one measured. In all measurements taken as the segment rotates about a fixed point or axis, the dial moves but the needle remains in the same vertical position or returns to it.

It is a condition of all measurements with this device that other movements of the body be held as nearly constant as possible. Three exceptions are made to this condition. In measures number 4 and 5, the bending of all the joints of the vertebral column are included. Again in measure number 2, a slight bending of the vertebral column takes place on the upward movement. The amount of this angle depends upon the flexibility of the back. A slight back bend also occurs in measure number 8.

To facilitate the accurate use of the instrument, standard starting positions and finishing positions are established for each movement. Position of dial and needle is checked and dial locked at the starting point; movement then takes place to the finishing position. The reading in degrees indicated by the needle is the number of degrees the segment has moved during the measurement.

MOVEMENTS MEASURED

Proof of the method and instrument has been based on the measurement of thirteen different movements. Of these, eight of the measures are for both the right and left sides of the body, making a total of twenty-one measures. The movements and their measurements are illustrated by the pictures accompanying this article.*

* **Editor's Note: The two line drawings of movements I and II (Figures III and IV) will indicate roughly the measuring technique employed. Owing to difficulties in reproducing photographs in the *Quarterly*, it is not possible to use the fine photographs available.**

Nature of the Data.—These thirteen flexibility tests were administered to fifty-six students attending the University of Oregon. Each of the subjects measured was given two trials during the same period for the purpose of investigating the reliability of the tests. Some subjects were given the tests before and after entering upon a three-month training schedule in body building. No attempt was made, however, to study the differences before and after the training period. Such measurement of differences obtained by exercise necessarily had to wait proof of the reliability and validity of the instrument and method. In all instances the subject was measured before the warm-up period and was in no instance allowed to perform any exercise or activity in order to warm up the body. This was not done necessarily for physiological reasons but rather to standardize testing procedure.

Treatment of the Data.—The data were collected as has been described, and were recorded. In order that the main points brought out in this study might be adequately discussed in terms of the problem, the data were treated by elementary statistical procedures. The results are summarized with the description of each movement. The means and standard deviations show something of the general characteristics of the data. In order to establish the reliability of the tests, trial one was correlated with trial two.

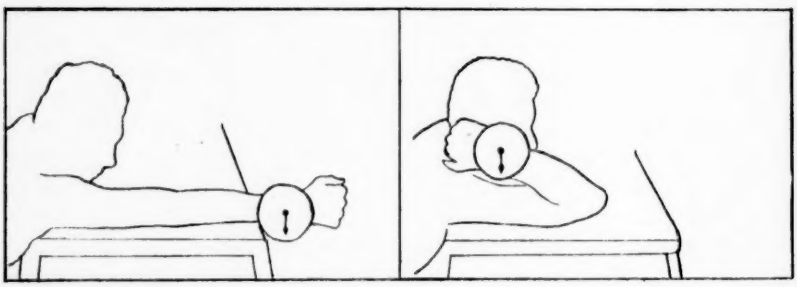

FIGURE III. Movement I—Elbow flexion and extension. Left, starting position; right, finishing position.

Movement I—Elbow Flexion and Extension.—The instrument is fixed to the back of the wrist, the arm is laid flat on a bench, thumb side of the hand up. The subject, keeping the upper arm flat on the bench, brings the hand upward in an arc, bending at the elbow to as close to the shoulder as possible. This measurement is taken for both right and left arms. (See Fig. III.)

Obtained Data:	*N*	*M*	σ	r_{11}
Left arm				
First trial	56	148.4°	10.1°	
Second trial	56	148.7	10.1	.971
Right arm				
First trial	56	150.3	5.9	
Second trial	56	150.1	5.7	.889

Movement II—Shoulder Flexion and Extension.—With the instrument in the same position as for Measure I, the subject stands erect with arms parallel to the sides at the projecting corner of a wall so that the arm to be measured extends just beyond the corner. The subject stands straight at all times keeping his shoulder blades, buttocks, and heels tight against the wall. He then moves his hand and arm backwards and upwards as far as possible, never allowing the arm to bend at the elbow or come away from the wall. The first reading is taken in this position. From this position he moves his arm in an arc forward over his head and as far back along the wall as possible. The recorded reading is taken in this position. This may be done for both right and left arms. (See Fig. IV.)

Obtained Data:	*N*	*M*	σ	r_{11}
Left arm				
First trial	56	243.3°	16.9°	
Second trial	56	244.4	17.4	.975
Right arm				
First trial	56	247.5	15.3	
Second trial	56	247.6	15.5	.980

Movement III—Ankle Flexion and Extension.—The belt is placed around the instep of the foot with the instrument on the inside of the

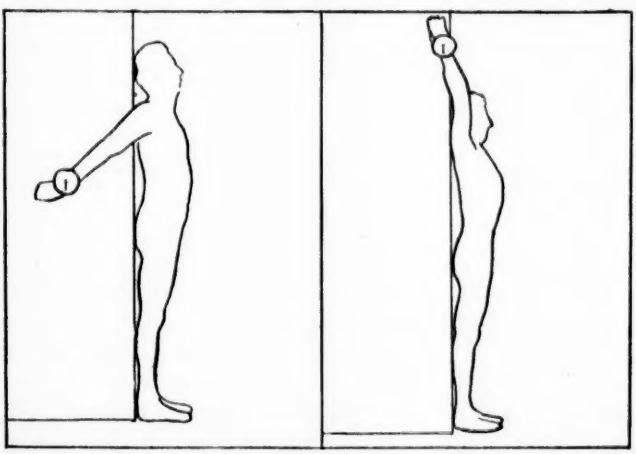

FIGURE IV. Movement II—Shoulder flexion and extension. Left, starting position; right, finishing position.

foot. The subject sits on a bench or table and extends his foot over the edge. The leg is kept straight and the knee locked at all times. In this position the foot is extended as far as possible (a reading is taken) and then flexed as far as possible (another reading is taken). The measurement may be made for both feet.

Obtained Data:	*N*	*M*	σ	r_{11}
Left leg				
First trial	56	61.9°	8.0°	
Second trial	56	62.6	7.5	.977
Right leg				
First Trial	56	62.5	8.4	
Second trial	56	62.9	8.3	.956

Movement IV—Trunk and Hip Flexion and Extension.—The instrument is fixed to the side of the chest, directly under the arm pit. The subject then stands at attention with his feet together, arms extended over head. Then keeping legs straight, knees locked, feet flat on floor he bends backward as far as possible, a reading is taken, and then forward as far as possible, when a second reading is taken. Either side may be used for purposes of the measurement.

Obtained Data:	*N*	*M*	σ	r_{11}
First trial	56	171.8°	20.2°	
Second trial	56	173.0	20.2	.997

Movement V—Sideward Trunk and Hip Flexion and Extension.—The instrument is shifted to the middle of the back, with the belt passing around the chest at nipple height. The subject stands at attention. Keeping the knees locked, feet together and flat on the floor, he bends to one side as far as possible, where the first reading is taken. (The subject is allowed to bend slightly backward, but never forward). The subject then bends as far to the other side as possible where the second reading is taken.

Obtained Data:	*N*	*M*	σ	r_{11}
First trial	56	103.3°	13.4°	
Second trial	56	103.8	13.8	.977

Movement VI—Hip Flexion and Extension.—The belt is placed around the waist at the height of the umbilicus, with the instrument at the waist at the level of the crest of the ilium. The movement is made in exactly the same manner as in movement four. Keeping the legs straight, knees locked, feet flat on the floor, he bends backward as far as possible, where the first reading is taken, and then forward as far as possible, when the second reading is taken. The instrument may be placed on either side.

Obtained Data:	*N*	*M*	σ	r_{11}
First trial	56	108.7°	25.1°	
Second trial	56	110.0	24.2	.994

Movement VII—Leg Abduction.—The instrument is fastened to the back of ankle. The subject stands at attention with feet together, where the first reading is taken. He then slides his feet out to the side as far as possible, in the manner of a sideward split. The second reading is taken in this position. This measure is taken for both right and left legs.

Obtained Data:	*N*	*M*	σ	r_{11}
Left leg				
First trial	56	54.4°	7.6°	
Second trial	56	54.6	7.7	.934
Right leg				
First trial	56	54.9	7.9	
Second trial	56	55.6	9.3	.972

Movement VIII—Extension and Flexion of the Leg.—The instrument is placed on the outside of the ankle. The subject stands with his back to the wall with the leg to be measured extended just beyond the edge of the projecting wall corner (as in Movement II). One hip, one heel, and one shoulder blade are kept against the wall at all times. The first reading is taken as the subject stands. Then, keeping the opposite knee locked and both knees together, the subject raises his foot in an arc to as near the buttock as possible, where the second reading is taken. This measurement may be taken for both right and left legs. The subject is allowed to brace himself in this movement with his hands on a stick or standard.

Obtained Data:	*N*	*M*	σ	r_{11}
Left leg				
First trial	56	122.7°	11.0°	
Second trial	56	123.7	10.3	.969
Right leg				
First trial	56	123.4	10.1	
Second trial	56	124.2	9.8	.957

Movement IX—Thigh Flexion.—The instrument is fixed to the side of the thigh. The subject stands with his back to a wall. With heels touching the wall at the start, the buttocks, shoulders and opposite heel touching the wall at all times and the opposite knee locked, he raises his leg, bringing the knee as near the chest as possible. The subject is again allowed a stick with which to brace himself in this movement.

Obtained Data:	*N*	*M*	σ	r_{11}
Left leg				
First trial	56	106.0°	15.0°	
Second trial	56	106.6	15.7	.995
Right leg				
First trial	56	100.4	12.8	
Second trial	56	101.2	12.4	.978

Movement X—Head Rotation.—The instrument is fastened to the center of the forehead. The subject lies face downward on a bench with his head projecting over the end. He rotates his head to one side as far as possible, where the first reading is taken, and then rotates it in the opposite direction as far as possible, where the second reading is taken. The shoulders are not allowed to be raised from the bench.

Obtained Data:	*N*	*M*	σ	r_{11}
First trial	56	173.7°	18.5°	
Second trial	56	174.8	18.9	.973

Movement XI—Head Extension and Flexion.—The instrument is fastened over the ear on the side of the head. The subject lies down on a bench, face up, with head projecting over the end. He lowers his head as far as possible, where the first reading is taken, then raises it as far as possible, where the second reading is taken. The shoulders are not allowed to be raised from the bench.

Obtained Data:	*N*	*M*	σ	r_{11}
First trial	56	140.6°	17.6°	
Second trial	56	140.2	16.9	.979

Movement XII—Wrist Flexion and Extension.—The instrument is fastened to the side of the hand just over the thumb and first finger. The fist is doubled but not clenched. The forearm is placed flat on a bench with the wrist projecting over the edge, knuckles up. The hand is flexed at the wrist as far as possible, where the first reading is taken, and then extended as far as possible where the second reading is taken. The measurement may be taken for both right and left hands.

Obtained Data:	*N*	*M*	σ	r_{11}
Left wrist				
First trial	56	164.1°	17.6°	
Second trial	56	164.7	17.8	.985
Right wrist				
First trial	56	161.0	18.2	
Second trial	56	162.9	18.8	.982

Movement XIII—Arm Flexion on the Back.—The instrument is fastened to the underside of the wrist. The subject stands at atten-

tion with thumb and forefinger placed on the lateral crests of the ilium, wrists straight, and feet apart enough to give solid stance. The first reading was taken in this position. The hand is then placed as far up the back as is possible (in the manner of a hammer lock position) where the second reading is taken. During the movement the body is not allowed to bend forward or sideward, nor is the position of the feet allowed to change. This measurement may be taken on both right and left arms.

Obtained Data:	*N*	*M*	σ	r_{11}
Left arm				
First trial	56	80.8°	14.1°	
Second trial	56	82.1	14.7	.969
Right arm				
First trial	56	76.7	15.0	
Second trial	56	77.9	14.8	.982

THE FINDINGS

There were a number of interesting points brought out by the analysis of data. They were:

1. The system of measurement with this device was found to be sufficiently reliable to warrant its use for measuring individuals or groups. It may be considered a highly reliable system of measurement according to test construction standards (see data).

2. It was found possible to apply this system of measurement to thirteen different movements as one means of measuring flexibility.

3. The measures thus obtained were directly comparable since the same unit of measurement and the same measuring device were used throughout.

4. Some indication of the values of means and standard deviation for the movements studied may be gained from a study of the data collected since these are valid for the group studied.

5. It was found that this system of measurement was not too time consuming in the collection of data for either individuals or groups. The average time required for the complete measurement of each subject was approximately twenty minutes.

6. It was demonstrated by the experience in giving the tests that the procedure in taking these measurements is not complicated nor highly technical, although the operator must proceed with due respect for accurate and careful procedure.

CONCLUSION

The data collected and analyzed in this study, in the opinion of the writer, show that the instrument and method devised for the

purpose of measuring flexibility or range of motion in thirteen segments were objective, reliable, and valid. It would seem apparent that many other applications of the device and method to segmental movements are possible.

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A Survey of Administrative Relationships of Departments of Physical Education in Colleges and Universities

By Gertrude M. Baker
University of Minnesota

At the end of the summer of 1941, a questionnaire was sent to 35 selected colleges and universities throughout the United States. The purpose of the questionnaire was to make an inquiry into the current practices in administrative relationships of representative departments of physical education for women. The basis of selection of the institutions was as follows: (1) widespread geographically, (2) relatively large, (3) well-established departments of physical education for both men and women.

Thirty-three, or 94 per cent of replies were received. The questionnaire results are arranged in three sections:

Part I. Budget, Requisitions, Policies, Personnel.

Part II. Programs.

Part III. Opinions of Women Directors.

TABLE I

Location of Responsibility in Preparation of the Physical Education Budget

	Preparation of Women's Budget		Preparation of Men's Budget
14	Head of Women	12	Head of Men
4	Head of Men and Women Head of Women	4	Head of Men and Women
3	Dean of Education Head of Women	3	Dean of Education Head of Men
2	Head of Men and Women	2	Head of Men and Women Head of Men
2	Head of Men Head of Women	1	Dean of Arts Head of Division of Physical Education
1	Dean of Arts Head of Women		
1	Dean of Education Head of School of Physical Education Head of Men and Women	1	Dean of Education Head of School of Physical Education Head of Men and Women

TABLE I—Continued

	Preparation of Women's Budget		Preparation of Men's Budget
1	Dean of School of Physical Education Professional Program Dean of College or Head of Men's Service Program	1	Dean of Education Professional Program Head of Men's Service Program
1	Dean of College Head of Men and Women Head of Women	1	Dean of College Head of Men and Women
1	Dean of Students Head of Men Head of Women	1	Head of Division of Physical Education
1	Head of School of Physical Education	1	Head of School of Physical Education
1	No Budget	1	No Budget
32	Total	28	Total

In 14 out of 32 institutions, or 43.7 per cent of the cases, the woman head of the women's department prepares the budget of that department. Similarly, in 12 out of 28 institutions, or 42.8 per cent of the cases, the head of the men's department prepares the departmental budget for men. The number of times that the budget is prepared separately by the women and men respectively is about the same. Clearly it is by far the commonest practice for women and men to prepare their respective budgets separately and independently.

TABLE II

AUTHORITY FOR APPROVAL OF REQUISITIONS FROM WOMEN'S DEPARTMENT

15	Head of Women directly to Administration
6	Head of Men's and Women's Departments
2	Dean of Liberal Arts
2	Dean of Education
1	Dean of college concerned
1	Dean of Students Business Manager Comptroller
1	Dean of Education Head of Men's and Women's Departments
1	Head of School of Physical Education
1	Head of Men's and Women's Departments W.A.A. faculty for women's athletics

TABLE II—Continued

	University administration direct from Head of Women's Department up to $2000
1	Board of Physical Education direct from Head of Women's Department up to $5000
	University administration direct from Head of Women's Service Department
1	Dean of College of Education direct from Head of Women's Teacher Training Department
32	Total

In 15 out of 32 institutions, or 46.8 per cent of the cases, the requisition is sent directly to the administration from the woman head of the women's department. This fact is consistent with the most frequent budget practice shown in Table I.

TABLE III

LOCATION OF RESPONSIBILITY FOR DEVELOPMENT OF DEPARTMENTAL POLICIES

	Women's Policies		Men's Policies		Athletic Policies
17	Head of Women	11	Head of Men	5	Head of Men
5	Head of Men and Women	5	Head of Men and Women	5	Head of Men and Women
2	Dean of Education Head of Women	2	Dean of Education Head of Men	3	Athletic Director
1	Dean of Arts Head of Women	1	Dean of Arts Head of Division of Physical Education	2	Head of Division of Physical Education
1	Head of School of Physical Education Head of Women	1	Head of School of Physical Education Head of Men	2	Athletic Director Head of Men
1	Head of School of Physical Education Head of Men and Women	1	Head of School of Physical Education Head of Men and Women	1	Dean of Education Head of Men
1	Head of School of Physical Education	1	Head of School of Physical Education	1	Head of Men and Women Head of Men
1	Head of Men and Women Head of Women	1	Head of Division of Physical Education	1	Athletic Director A. S. U. W.
1	School of Health Head of Women	1	Head of Men and Women Head of Men		
		1	School of Health Head of Men		
30	Total	25	Total	20	Total

In 17 out of 30 institutions, or 56.6 per cent of the cases, the woman head of the women's department is responsible for the development of policies of that department. In 11 out of 25 institutions, or 44 per cent of the cases, the head of the men's department is responsible for the policies of the men's department. The separate and independent development of policies for the women's department by the woman head is not only the commonest practice for women's departments but is 12.6 per cent more frequent than the commonest practice in the case of the men.

TABLE IV

SELECTION OF PERSONNEL OF WOMEN'S DEPARTMENT

14	Head of Women
5	Dean of Education Head of Men and Women
3	Head of Men and Women
2	Head of Men and Women Head of Women
1	Dean of Education Head of School of Physical Education
1	Dean of Education Head of Men and Women
1	Dean of Arts Head of Men and Women
1	Dean of Students Head of Men Head of Women
1	Dean of Colleges Head of Men and Women
1	Head of Division of Physical Education Head of Women
1	Head of Women's Division (woman) Head of Women
1	Head of School of Physical Education Head of Women
32	Total

In 14 of 32 institutions, or 43.7 per cent of the cases, the woman head of the women's department is responsible for the selection of the personnel of that department. The second most frequent practice was in 5 out of 32 institutions, or 15.6 per cent of the cases, the selections being done jointly by the Dean of Education and the man head of the department for men and women.

Summarizing Part I, we see that in 44 to 56 per cent of the in-

stitutions, or approximately 50 per cent of the time, the location of responsibility for budget, requisitions, policies, and personnel of the departments of physical education for women resides in the woman head.

PART II. PHYSICAL EDUCATION PROGRAMS

TABLE V

LOCATION OF RESPONSIBILITY FOR THE SERVICE PROGRAM

Men's Program		Women's Program		Combined Program	
15	Head of Men	21	Head of Women	4	Head of Men and Women
2	Head of Men and Women	2	Head of Men and Women	3	Head of Men Head of Women
1	Dean of College Head of Men and Women		College Head of Men	1	Dean of College Head of Men and Women
	Dean of Education Head of School of	1	Head of Women Dean of Arts Head of Women		Head of School of
1	Physical Education Head of Men and Women Head of Men	1	Dean of College Head of Men and Women	1	Physical Education Committee of Men and Women
	Head of School of		Dean of Education Head of School of	1	Head of School of Physical Education Head of Men and Women
1	Physical Education Active Committee of Men and Women	1	Physical Education Head of Men and Women Head of Women		
1	Head of Division of Physical Education Committee on Course of Study (arts)	1	Head of Women Committee on Course of study (arts)		
1	Head of Men and Women Head of Men	1	Head of School of Physical Education Active Committee of Men and Women		
1	Head of Division of Physical Education	1	Head of Women Curriculum Committee (arts and T. Coll.)		
		1	Head of Men and Women Head of Women		
		1	Head of Men Head of Women		
23	Total	31	Total	10	Total

In 21 of 31 institutions, or 67.7 per cent of the cases, the woman head of the women's department is responsible for the women's service program. In a similar number of instances, 15 of 23 institutions, or 65.2 per cent of the time, the head of the men's department is responsible for the men's service program.

TABLE VI

LOCATION OF RESPONSIBILITY FOR THE PROFESSIONAL UNDERGRADUATE PROGRAM

	Men's Program		Women's Program		Combined Program
9	Head of Men	10	Head of Women	6	Head of Men Head of Women
3	Dean of Education Head of Men	3	Dean of Education Head of Women	4	Head of Men and Women
2	Head of Men and Women	2	Head of Men and Women		Dean of Education
1	School of Education Committee	2	Head of Men and Women Head of Women	2	Head of Men and Women
	Dean of Education			1	School of Education Committee
1	Head of Division of Physical Education	1	School of Education Committee		Dean of Education
	Head of School of		Director of Division of Physical Education	1	Faculty Committee Head of Men Head of Women
1	Physical Education Head of Men and Women Head of Men	1	Dean of Home Economics Dean of Sciences Head of Women	1	Dean of Education
1	School Health Committee Head of Men		Dean of Education		Dean of Letters and Sciences
	Head of School of	1	Head of Division of Physical Education Head of Women	1	Head of Men and Women Head of Women
1	Physical Education Teacher Education Committee for Men and Women		Head of School of		Head of School of
		1	Physical Education Head of Men and Women	1	Physical Education Head of Men and Women
1	Head of Division of Physical Education		Head of Women		Head of School of
	Head of Men	1	School Health Committee Head of Women	1	Physical Education Teacher Education Committee for Men and Women
1	Head of Women Head of Men and Women		Head of School of Physical Education	1	Head of Women
1	Head of Men Head of Women	1	Teacher Education Committee for Men and Women		
		1	Head of Men Head of Women		
22	Total	24	Total	19	Total

In 10 of 24 institutions, or 41.6 per cent of the institutions, the woman head of the women's department is responsible for the professional undergraduate program; in an additional 12.5 per cent of the institutions, the Dean of Education and the woman head of the

women's department carry the responsibility jointly. Almost the identical figures are true for the head of men and his responsibility for the professional undergraduate program for men.

TABLE VII

LOCATION OF RESPONSIBILITY FOR THE PROFESSIONAL GRADUATE PROGRAM

Men's Program	Women's Program	Combined Program
2 Head of Men and Women	3 Head of Women	6 Head of Men and Women
2 Head of Men	2 Head of Men and Women	3 Head of Men Head of Women
1 Dean of Graduate College Head of Division of Physical Education	2 Dean of Graduate School Head of Women	1 Dean of Graduate College Joint Committee of Men and Women
1 Dean of Education Head of Men	2 Head of Men and Women Head of Women	1 Dean of Graduate School Head of School of Physical Education Head of Men and Women
1 Dean of Education Head of School of Physical Education	1 Dean of Graduate School Head of School of Physical Education Head of Men and Women	1 Dean of Education Head of Men and Women
1 Dean of Education Head of Men and Women	1 Dean of Education Head of Men and Women	1 Committee on Graduate Study School Education
1 Committee of Graduate Study School Education	1 Dean of Education Faculty Committee Head of Women	1 Head of School of Physical Education Graduate Committee of Men and Women
1 Head of Division of Physical Education Graduate Council	1 Graduate Council Head of Women	1 Head of Women
1 Head of School of Physical Education Graduate Committee for Men and Women	1 Head of School of Physical Education Graduate Committee of Men and Women	
1 Head of Men and Women Head of Men Head of Women	1 Graduate Study Committee of School Education	
1 Curriculum Committee School Health Head of Men	1 Dean of Education	
1 Head of Men Head of Women	1 Curriculum Committee of School Health Head of Women	
1 Head of Women	1 Head of Men Head of Women	
15 Total	18 Total	15 Total

The data for both the men's and women's departments show that the responsibility for the separate programs varies widely in the various institutions that have a professional graduate offering in this field. The responsibility for the combined graduate program in 6 of 15 institutions, or 40 per cent of the instances, resides in the man head of men's and women's work. So far as the separate responsibility for the women's program is concerned, the woman head of the women's department carries it 16.6 per cent of the time, or in 3 out of 18 institutions.

TABLE VIII

LOCATION OF RESPONSIBILITY FOR THE RECREATIONAL PROGRAM

Men's Program		Women's Program	
15	Head of Men	26	Head of Women
4	Head of Men and Women	3	Head of Men and Women
1	Head of Division of Physical Education		Student Deans
		1	Head of Women Head of Men
1	Intramural Director Head of Men and Women	1	Dean of Arts Head of Women
	Dean of Arts		
1	Head of Division of Physical Education		
	Director of Athletics		
1	Intramural Council R. O. T. C.		
23	Total	31	Total

In 21 of 26 institutions, or 80.7 per cent of the instances, the woman head of the women's department is responsible for the recreational program for women. In the case of the recreational program

TABLE IX

LOCATION OF RESPONSIBILITY FOR THE INTERSCHOLASTIC PROGRAM

8	Head of Men	1	Athletic Division A. S. U. W.
5	Athletic Director	1	Association of Students
2	Head of Division of Physical Education	1	W. A. A. Board Athletic Council
2	Head of Men and Women	1	Department of Athletics
1	Division of School of Health		
1	Athletic Committee		
1	Head of Men and Women Head of Men		
1	Athletic Director Head of Men		
21	Total	25	Total

for men, the head of men is responsible in 15 of 23 institutions, or 65.2 per cent of the cases.

The agency responsible for the intercollegiate program varies considerably. The commonest mention is made of the head of men's physical education—that is, in 8 of 25 institutions, or 32 per cent of the instances. In 20 per cent of the institutions, the athletic director has the responsibility for this program.

Summarizing Part II, we see that the responsibility for both the service and recreational programs for women resides in the woman head of the women's program from two-thirds to four-fifths of the time. The responsibility for the separate undergraduate programs is carried most frequently by the woman head of the women's work and the head of the men's work respectively. The man head of both men's and women's physical education is most commonly responsible for the combined graduate program. Responsibility for separate women's and men's graduate programs varies widely.

PART III—SUMMARY OF THE REACTIONS OF THE WOMEN DIRECTORS OF PHYSICAL EDUCATION

In summarizing these reactions, meanings are given more significance when institutions are grouped according to relative independence in administrative functioning of the departments of physical education for women. The following terms imply the degree of independence of the women's departments in relation to responsibility for the budget, requisitions, departmental policies, selection of personnel and the various programs of work:

Independent—Woman head of women's department is entirely or almost entirely responsible for the items listed.

Chiefly Independent—Woman head of women's department is responsible for more than half of the items listed.

Combined—Practically all of the items are under the control of a male head of men's and women's departments or male head of a school of physical education alone, or in some joint capacity with the woman head of the women's department, or Dean of Education or Arts or some other college.

Chiefly Combined—Male head of men's and women's departments or male head of men's department or both, and woman head of women's department are jointly responsible for more than half of the items listed.

Combined with College of Education—Listed items are mostly under the joint control of the Dean of Education and the head of the women's department.

Complex—Control of the listed items varied so much within one institution that classification was difficult.

TABLE X

NUMBER OF DEPARTMENTS OF EACH TYPE AND AVERAGE NUMBER OF YEARS OF OPERATION OF TYPE

Type of Organization	Number of Departments	Average Number of Years in Operation
Independent	12	23.1 years
Chiefly independent	5	11.8 "
Combined	9	15.1 "
Chiefly combined	2	5.0 "
Combined with College of Education	2	?
Complex	3	?

Seventeen departments, or those in about half of the institutions contacted, were either entirely independent or chiefly so; 11, or 33 per cent, were combined with the men's department of physical education; 2 women's departments, or 6 per cent, were combined with the College of Education although 3 others specifically mention that some partial combination with the College of Education would be desirable.

The average number of years is interesting in that the independent departments have been in that category for the longest period of time—23.1 average years. The combined type is second in rank order with 15.1 average years, a considerable period of time for a basis of opinion.

The questionnaire specially called for strengths and weaknesses of the existing type of organization. For clarity the answers are summarized in two large groupings. Group I includes two types: independent and chiefly independent, a total of 17 institutions. Group II includes three types: combined, chiefly combined, combined with College of Education, a total of 13 institutions. The various reasons submitted are stated in the following lists:

STRENGTHS OF INDEPENDENT AND CHIEFLY INDEPENDENT DEPARTMENTS AS GIVEN BY WOMEN DIRECTORS

Efficiency in organization of each department; works well.
Interests of women students better served.
Interests of women staff better served.
Problems of men and women are different; therefore, separation necessary.
Administration more efficient because in hands of person most familiar with needs.
Physical education committee on graduate study unifies graduate program.
Practically, centralization has not worked.
Direct contact with administration means more understanding of women's setup.
Strengths far outweigh weaknesses.

WEAKNESSES OF INDEPENDENT AND CHIEFLY INDEPENDENT DEPARTMENTS AS GIVEN BY WOMEN DIRECTORS

Some overlapping with men's department.
Not in line with other training departments.
Promotions more difficult.

Combination of men and women in graduate work tends to lower standards of women's work.

Possible lack of cooperation between men's and women's departments if personnel such that misunderstandings occur.

Administrators claim separate departments are more expensive—"not proven to be in our case."

STRENGTHS OF DEPARTMENTS COMBINED, CHIEFLY COMBINED, AND COMBINED WITH COLLEGE OF EDUCATION AS GIVEN BY WOMEN DIRECTORS

Mutual understanding of problems and breadth of outlook.
Simplification of administration.
Strength to field; unification if cooperation.
Prestige in institution.
Public relations strengthened.
Double setup means savings in facilities.
More economical in use of teaching staff; in use of clerical staff.
Funds from men's athletics sometimes available for women's facilities.
Strengths largely dependent upon type of person at head; if not an educator this plan most unsatisfactory.

WEAKNESSES OF DEPARTMENTS COMBINED, CHIEFLY COMBINED, AND COMBINED WITH COLLEGE OF EDUCATION AS GIVEN BY WOMEN DIRECTORS

Lack of sympathy with women's work; women's needs not recognized.
Desire to dominate women's work.
Too much red tape.
Policies and practices of women's department different from those of men's department.
Would be bad organization if personalities did not adapt easily.

TABLE XI

TYPE OF ORGANIZATION FAVORED BY WOMEN DIRECTORS

Favor complete independence	16, or 48 per cent
Favor independent department units in combined organization	5, or 15 per cent
Favor one single department	6, or 18 per cent
Favor combination with College of Education	2, or 6 per cent
No definite statement	4, or 12 per cent

By far the largest per cent of the women directors of representative colleges and universities in the United States favor separate and independent departments of physical education for women and men respectively. Whether functioning in a department that is already independent or chiefly so, or in a department that is combined with the men's department, the majority of women directors favor complete cooperation with the men's department, the health division, and other college and university administrative units, but full responsibility and authority for their own departmental budget, requisitions, policies, personnel, and programs.

The consensus in this survey coincides with that of directors of men's and women's departments of selected universities and of ten outstanding experts analyzed in the only significant study done on this subject: "Organization of the Required Physical Education for Women in State Universities" by Georgia B. Johnson (T. C. Con-

tribution to Education, Number 253, Bureau of Publications, Teachers College, Columbia, 1927).

The following is an excerpt from the above report, page 89: "Eighty-nine replies were given by directors of physical education for women. Of these 77, or 87 per cent, favor separate departments for men and women. Of the 119 replies received from the men 56, or 49 per cent, favor separate departments for men and women."

LIST OF INSTITUTIONS USED IN THE SURVEY

Boston University
University of California at Berkeley
University of California at Los Angeles
University of Chicago
University of Cincinnati
Coe College
University of Colorado
Cornell University
George Washington University
Georgia University
University of Illinois
Indiana University
State University of Iowa
Louisiana State University
Miami University
University of Michigan
University of Missouri
University of Nebraska
Northwestern University
Oberlin College
The Ohio State University
Ohio Wesleyan University
University of Oregon
Pomona College
Purdue University
University of Southern California
Stanford University
Syracuse University
Temple University
University of Texas
Washington State College
Washington University
University of Wisconsin

An Evaluation of the Physical Status of City College Students on the Basis of Two Standardized Tests

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IN VIEW of the emphasis upon physical fitness, the investigators undertook to evaluate the physical proficiency of a cross section of City College students. In order to establish a basis of comparison, two standardized tests of national repute were employed. The Cozens General Athletic Ability Test for College Men[1] was chosen because the battery of test items included in it constitute a valid measure of both gymnastic and athletic abilities. In order to obtain a further picture of the physical status of the individuals, the Rogers Physical Capacity Test[2] was selected, since it reputedly measures an element basic in all motor skills, namely, strength.

The subjects for the study were City College students in required physical education courses, consisting of matriculated freshmen and sophomores in all branches of college specialization. All students are required to take four semesters of physical education.

It might be interesting to note at this point that the student body of the College of the City of New York represents an urban group, rather homogeneous with respect to social and economic status, drawn for the most part from the middle brackets of our population.

Over a period of two years the investigators administered the batteries of tests to several classes, numbering from 100 to 200 students. Complete data in the Cozens tests were thus obtained for 493 subjects and in the Rogers tests for 374 cases. A summary of these data are contained in Table I.

The mean scores obtained by Rogers and Cozens in the original standardizations of their tests along with the means obtained in this study are presented in Table II for purposes of comparison.

To clarify further the significance of some of these data, a curve of the frequency distribution was constructed for the Cozens data.

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1 F. W. Cozens, *The Measurement of General Athletic Ability in College Men* (Eugene: University of Oregon Press, 1929).

2 F. R. Rogers, *Physical Capacity Tests in the Administration of Physical Education*, Contributions to Education No. 173 (New York: Columbia University, 1926).

TABLE I

A Summary of the Data Obtained in This Study on the Cozens and the Rogers Tests

Data on Rogers' Test N=374		Data on Cozens' Test N=493	
Strength Index	M=1210	Athletic Ability	M=248
Strength Index	S.D.=53	Athletic Ability	S.D.=86.8
Strength Index	Range=650-1850	Athletic Ability	Range=6-436
Age	M=17	Age	M=18
Height	M=5-8	Height	M=5-8½
Weight	M=140	Weight	M=146

TABLE II

Comparison of Mean Scores

	Rogers' Test		Cozens' Test	
	Rogers' Study	This Study	Cozens' Study	This Study
Means	1761	1210	350	248

The ogive for the City College group represents the distribution of their scores on the Cozens test. In constructing the ogive for the original Cozens group, the following procedure was followed. Where Cozens established five classification areas over a range of six sigmas to give each classification interval a value of 1.2 sigmas, the investigators established ten intervals by giving each a value of .6 sigmas. From these sigma values, theoretical frequencies were obtained at the scores indicated by Cozens[3] in his table of classification areas. These graphs are reproduced in Figure 1.

The disparity between the mean score of the City College group and the mean established by Cozens in his origination of the test reveals the inferior level of physical performance of the former. From Figure I it is readily seen that 432 cases, or 88 per cent of the City College students, fall below the Cozens mean score of 350. Of this number, 365 students, or 74 per cent of the cases, fall within Cozens' two subnormal groups, the lowest group comprising 138 students, or 28 per cent (score of 204 and below).

This comparison is made even more striking if it is realized that these classifications were constructed by Cozens on the basis of a normal distribution wherein the last two groups should theoretically contain only 164 cases, or 33 per cent. But in this study they are found to contain 365 cases—twice as many.

With reference to the data on the Strength test, Rogers' tables indicate that for an average age of 17 and weight of 140 lbs., the Strength Index norm should be 1761.[4] The obtained Strength Index

[3] F. W. Cozens, *Achievement Scales in Physical Education Activities for College Men* (Philadelphia: Lea & Febiger, 1936) 115.

[4] F. R. Rogers, *op. cit.*, p. 58.

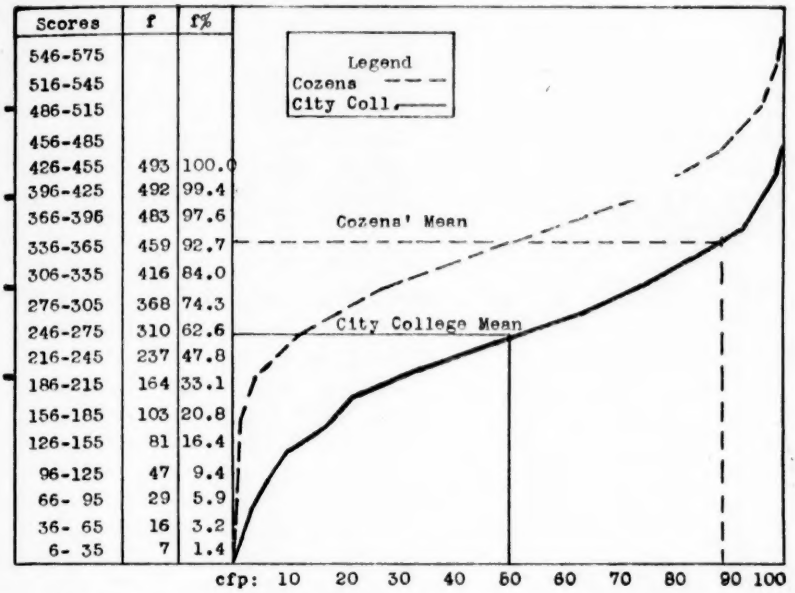

FIGURE I. Comparison between the distribution of City College students and the Cozens original distribution on the General Athletic Ability Test for College Men.

mean of 1210 by the City College group is comparable to the norm for age 15 and weight 115 lbs. While it is generally recognized that Rogers' original indices are rather high, the retardation of two years for the City College group definitely establishes them as below average in the element of strength and physical capacity as measured by the Rogers test.

CONCLUSION

The results presented in the foregoing section indicates the City College students to be markedly inferior in their physical status. On the basis of the tests employed, it may be said that they are below normal for college students in strength, agility, speed of movement, endurance, and general athletic skills. In light of the present war emergency and the necessity of physical fitness for every member of our population it would seem imperative that further investigation be undertaken to determine how widespread is the condition of such lack of fitness. Further, an attempt should be made to learn the most probable reasons for similar existent deficiencies wherever they are found.

Reflecting on the reasons for the low physical status of the City College group, several possible suggestions occur to the writers. First, the students come from homes of a lower economic scale than the

average college student. This factor may plausibly be related to their poor physical status through malnutrition and reduced time for leisure. Second, the student body of the college represents a group whose scholastic average is extremely high. This may have been achieved at the expense of decreased physical activity on the high school level. Finally, the physical inferiority of the City College group may be related to as yet uninvestigated racial and geographical characteristics.

Whatever the causes for such physical inferiority on the college level or elsewhere, they should be found and corrected in the interests of the individual and the nation.

Saddle Sense

Recommended Fundamentals of Riding

By PHYLLIS P. VAN VLEET
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THE outstanding types of riding generally accepted in this country today are Show, Western, and Forward. Variations of these types are used in polo, racing, hunting, hacking, and variations in terminology name the Cavalry, Modern, Park Seat, etc., as types of riding. It can be readily understood that the purpose of each particular type determines the details of the form used for that type. For example, the Show seat is used to show the gaited horse to his best advantage in natural and unnatural gaits; the Western seat for long range or trail rides in comfort, and the Forward seat for cross country riding and jumping—a position of readiness.

The average riding situation in schools and colleges does not permit the use of the gaited horse (or extreme Show seat), the hunter (or extreme Forward seat), the Western cow pony (or sitting trot). This study will present, therefore, an analysis of the fundamental elements basic to all types of riding to determine a recommended technique for the school or college program where the horses available are not thoroughbred or saddlebred but safe, dependable school horses.

The fundamental elements used in this study have been compiled from some of the best technical material for teaching riding that is available at the present time.* These elements have been compared to determine any agreement or differences among the references used and to serve as a basis for teaching the fundamentals of riding.†

Classification of the elements will give a better understanding of the way in which they will be treated in relation to the present study. The following outline is suggested:

I. THE BALANCED SEAT IN THE SADDLE AT A STAND.
- A. Body Position
  - 1. Head and chin
  - 2. Eyes
  - 3. Neck
  - 4. Shoulders
  - 5. Chest
  - 6. Back
  - 7. Seat (buttocks)
- B. Arms
  - 1. Upper Arms
  - 2. Elbows
  - 3. Wrists
  - 4. Hands
- C. Legs
  - 1. Thighs
  - 2. Knees
  - 3. Calves
  - 4. Ankles
  - 5. Feet
  - 6. Heels
  - 7. Toes
- D. Balance

* Refer to Bibliography at end of article for technical material used as reference.

† A teaching film, "Saddle Sense," has been developed from the fundamentals stated in this study. Information about it may be obtained from the author.

II. The Aids
- A. Primary Aids
  - 1. Hands 2. Legs 3. Weight
- B. Secondary Aids
  - 1. Voice 2. Crop 3. Spurs
- C. Application of the Aids
  1. Putting the horse into motion (increasing the gait)
  2. Decreasing the gait
  3. Backing
  4. Turning (from right to left)
     a) While progressing
     b) In place
  5. The canter (left lead)
  6. Changing leads at a canter (from left to right)

III. Supplementary Elements
- A. Equipment
  - 1. Stirrups 2. Reins
- B. Mounting
- C. Dismounting

After comparing the elements included under the Balanced Seat in the Saddle at a Stand, the following seat is recommended. In front of each element will be recorded the extent to which the experts* agree or disagree. In cases where there is a decided choice of methods employed, the one most applicable to the average situation will be used. This choice is determined by the author's judgment of the simplest and safest method.

KEY TO TABLES

G.A.—General agreement (no disagreement).
V.S.D.—Very slight disagreement (one significant disagreement).
S.D.—Slight disagreement (more than one disagreement).
G.D.—General disagreement.
O.—No comment made (recommendation based on author's experience).

TABLE I

The Balanced Seat in the Saddle at a Stand

	Comparison	Element	Recommended Seat
Body Position	G.A.	Head and Chin	Up and in free unconstrained position to move with ease in every direction.
	G.A.	Eyes	Look ahead between horse's ears but do not fix eyes on one point.
	G.A.	Neck	Erect without stiffness.
	G.A.	Shoulders	Carried squarely but relaxed.
	G.A.	Chest	High.
	V.S.D.	Back	Lower back very slightly arched—no stiffness.
	V.S.D.	Seat	Sit as far forward in saddle as possible. Fleshy part of buttocks to rear and do not form part of seat.

* See Bibliography.

Arms	G.A.	Upper arms	Hang naturally, free and relaxed.
	G.A.	Elbows	Bend to make straight line from point of elbow to horse's mouth. Hold close to sides and slightly in advance of point of hips.
	G.A.	Wrists	Straight and supple.
	S.D.	Hands	Reins held in either one or two hands (two recommended). Fingers relaxed. Backs of hands from horizontal to vertical position (30°-45° recommended). Hands low and ahead of body — approximately over horse's withers.
Legs	G.A.	Thighs	Inner sides rest without constraint against saddle.
	G.A.	Knees	Down as low as adjustment of stirrups will allow. Inner side in continuous contact with saddle.
	V.S.D.	Calves	Extend downward and backward from knee. Inside in light contact with horse.
	G.A.	Ankles	Flexed and relaxed.
	G.A.	Heels	Well down.
	G.A.	Toes	Up.
	S.D.	Feet	Sole everted slightly—foot at home or with broadest part on stirrup tread.
	G.A.	Balance	Rider to be in balance should be "with the horse." Keep center of gravity of rider as nearly over center of gravity of horse as possible (withers—points of buttocks).

The Primary Aids are of utmost importance. Mastery of their use and application is essential to all types of riding. A detailed comparison of the Primary Aids is given in Chart I to give emphasis to the fact that there can be no words to give a person the "feel" of their use.

The Secondary Aids will not be compared in table form inasmuch as they are supplementary to the Primary Aids and should, therefore, play a minor part.

CHART I

COMPARISON OF THE ELEMENTS KNOWN AS PRIMARY AIDS

Author	Hands
Chamberlin	Reins should be gently stretched and taut, elbows bent, joints of shoulders and fingers almost relaxed. Reins not too tight or too loose. Good hands — "when rider can keep a softly stretched rein of unvarying intensity, with hands that are gentle and elastic he may be said to have good hands." Intensity of hand's resistance must be just equal to that offered by the horse; never more.
Farshler	Cultivate light hands. Apply force only when necessary, otherwise a very gentle "feel" of the horse's mouth at all times.

CHART I—(Continued)

Fillis	Can gauge sensibility of the mouth by alternative feeling of the curb and snaffle and can find out if horse has hard or soft mouth. In this way can readily get *good* or *light* hands, with which we can manage almost any horse by continued play of "take and give." *Well-trained hand*—remains fixed in position by strongly closing the fingers when the horse pulls—but the moment the horse yields his lower jaw the fingers should be relaxed with the rapidity of an electric flash. A *good hand*—gives when the horse takes and takes when he gives. A *well-trained* hand gives when the horse gives and takes when he takes, instantaneously.
Fort Riley	Contact is that gentle liaison which should exist between the hand of the rider and the mouth of the horse. This soft, steady contact with the mouth is maintained by having the elbows partly bent, and the joints of the shoulders, elbows, wrists, and fingers almost completely relaxed. The hands may *act, resist, or follow.* The hands *act* when they are increasing tension on the reins. They *resist* when they are fixed in place . . . they *follow* when they follow the movements of the head and neck. It is very important to know when they should properly act, resist, or follow. The *actions* of the hands should be progressive. The *resisting* hand should yield when the horse yields. The acting and resisting hands affect the equilibrium or impulsion of the horse; the following hand, while preserving the contact, opposes neither the impulsion nor the displacement of weight. The intensity of the hands' resistance must be just equal to that offered by the horse, never more. It is only by a closing more or less energetic, or by an opening, more or less complete, of the fingers that the rider transmits his will.
Littauer	Checking and directing control. Give and take with reins—must be varieties of pressure—not constant pull. Educated, which are really good hands; they can be defined thus: "good hands" are the action of fingers, hands, and arms which in the shortest time obtains the greatest results, with the least expenditure of the horse's mental and physical energies. Hands should always feel the horse's mouth.
McTaggart	A matter of adaptability—keep hands steady.
Santini	Light hands—do not rely on reins.

Author	Legs	Weight
Chamberlin	Squeeze gently then progressively more. Use of one leg pushes horse to opposite side.	Some weight in stirrups at stand, walk, trot. Weight on upper, inner part of thighs and much goes through relaxed knee and ankle joints to heel during canter.
Farshler	In emergency — one's equilibrium is sustained by gripping with upper leg from thigh to and including knee. Lower leg used to control hind quarters.	

Fillis	Used simultaneously they are agents of propulsion. When one acts stronger than the other it is an agent of direction.	Carried by buttocks.
Fort Riley	Should be steady — when they act simultaneously they move the horse forward. Legs may *act, resist,* or *yield.* They *act* when their pressure increases to determine a movement; they *resist* when they remain constant in pressure and when the pressure is opposed to a displacement of the hind quarters; they *yield* when their pressure diminishes and allows displacement. *Act* and *resist* are active movements, yielding is passive. Action should be produced a little in rear of the girth. One leg pushes hind quarters in opposite direction.	M u s t not normally support weight in stirrups. Slight increase in weight borne upon thighs, knees, stirrups at a walk.
Littauer	Good legs are the action of thigh, knees, calves, and sometimes heels, which, in the shortest time obtain the greatest results, both in gripping and controlling, with the least expenditure of the horse's mental and physical energy. Lower legs are urging control, variation of pressures stronger than original one used for gripping. To move horse forward—apply pressure with legs. Keep lower legs always near the horse's side.	As near over horse's center of g r a v i t y (withers) as possible. Considerable weight in stirrups in slow equitation. Keep weight in middle of rider's base of support.
McTaggart	Legs provide propulsion for horse. Press horse with knees "into his bridle" to move him. Do not grip to get good seat.	Whole weight rests on saddle. Slight bit on legs — same on stirrups.
Santini	Well regulated pressure of knee and calf.	

TABLE II

RECOMMENDED USE OF THE PRIMARY AIDS

Comparison	Element	Recommended Use of Aids
G.A.	Hands	Should be gentle and light. Should "feel" horse's mouth. A *good* hand—gives when the horse takes and takes when he gives. A *well-trained* hand—gives when the horse gives and takes when he takes, instantaneously. Intensity of hand's resistance must be just equal to that offered by the horse; never more.
V.S.D.	Legs	Pressure of both legs simultaneously act as propulsion agents. Pressure of one leg more than the other will move hind quarters of horse to opposite direction.
S.D.	Weight	Some weight in stirrups. Most of weight in middle of rider's base of support (points of buttocks, inside of thighs, knees). Over horse's center of gravity as near as possible.

TABLE III

RECOMMENDED APPLICATION OF THE AIDS

	Comparison	Element	Recommended Application of Aids
Putting Horse in Motion —Increasing Gait	G.A.	Hands	Shorten or collect reins to increase tension. Release tension of reins when horse moves and then establish contact again with mouth.
	G.A.	Legs	Should act simultaneously. Progressive pressure. Steady. Position the same as for stand.
	S.D.	Weight	Incline body forward (depends on speed). More weight on thighs, knees, stirrups.
Decreasing Gait	G.A.	Hands	Increase tension of reins. Fix and resist with fingers.
	G.D.	Legs	Position remains the same. Decrease action.
	V.S.D.	Weight	Slightly back to point of buttocks.
Backing	G.A.	Hands	Pull on reins—"give and take". (Horse takes two or three steps and stops—then pull again).
	G.A.	Legs	Press simultaneously.
	G.D.	Weight	Very slight shift to rear.
Turning While Progressing Left—Right	G.A.	Hands	Move both hands to right. Right rein pulls harder and straight back. Left rein presses against lower part of neck.
	S.D.	Legs	Urge horse forward with both legs equally. If necessary (if horse displaces haunches) use left leg more.
	O.	Weight	Remains the same.
Turning in Place Right—Left	S.D.	Hands	Pull left rein.
	V.S.D.	Legs	Use left leg energetically. Slightly in rear of girth.
	S.D.	Weight	Slight displacement of seat towards right, if any.
The Canter—Right Lead	G.A.	Hands	Collect horse. Carry both hands to left and feel off reins a little stronger than near. Right indirect rein against neck. Release tension of reins when horse begins.
	G.A.	Legs	Use legs vigorously at first to get horse on bit. Then use left leg stronger and a little back of girth.
	S.D.	Weight	Weight slightly to left and back until moment that canter starts.

TABLE III—(Continued)

RECOMMENDED APPLICATION OF THE AIDS

	Comparison	Element	Recommended Application of Aids
Changing Leads at Canter Right—Left	G.A. (limited reference)	Hands	Left rein acts as indirect rein of opposition in front of withers. (3) Right rein must act as direct rein of opposition—keep horse collected until precise moment. (4)
	G.A. (limited reference)	Legs	Right leg must take over impulsion of left. (1) Left leg must act only to push horse into bit. (2)
	G.A. (limited reference)	Weight	Seat must be shifted from left to right. (5)

The Supplementary Elements determine *styles* in riding, i. e., long or short stirrups; reins held high or low, in one hand or in two; balls of feet resting on stirrup treads or the feet "at home" in the stirrups, and so forth. The Supplementary Elements do not determine a good rider or a poor rider but they do determine good taste and bad taste according to when and where they are used. There is no need to ride an average school horse as though he were a five-gaited show horse racking around the show ring, a hunter about to clear a 4-foot post and rail, or a Western pony ambling up a mountain trail. The best results will be obtained if the simplest methods are employed as long as they are the safest and the most efficient.

TABLE IV

RECOMMENDED TECHNIQUE FOR APPLICATION OF SUPPLEMENTARY ELEMENTS

Comparison	Supplementary Elements	Recommended Technique
S.D.	Stirrups	Tread should hang approximately opposite lower edge of ankle bone.
G.D.	Reins 1. Single snaffle held in both hands.	Suggested Positions: 1. Take reins into hand between third and fourth fingers. Reins come over index finger. 2. Take reins into hand between little and fourth finger. Come out over index finger. 3. Take reins in under little finger. Come out over index finger. (Recommended).

TABLE IV—(Continued)

RECOMMENDED TECHNIQUE FOR APPLICATION OF SUPPLEMENTARY ELEMENTS

Comparison	Supplementary Elements	Recommended Technique
V.S.D.	2. Double rein held in both hands.	1. Curb rein on inside—snaffle on outside. 2. Separate two reins with little fingers as they go into hand—both come out over index finger—press with thumb.
O.	3. Single rein held in one hand (left).	1. Off snaffle under little finger—near snaffle between little and ring finger. Both come out over index finger.
Limited reference	4. Double rein held in one hand (left).	One curb between little and ring finger and other between middle and ring finger. One snaffle under little finger and other between middle and index. Snaffle outside curb. All come out over index finger.
S.D.	Mounting	Standing at left shoulder—facing rear. Reins in left hand—adjust them short and hold in left hand—place on horse's withers. Take stirrup in right hand and help left foot go into it—stirrup leather flat against boot. Two little jumps to develop spring—gradually turn body to horse and hold cantle with right hand. With final jump, assisted by pull of both arms, jump up. Straighten body, stand in stirrup with left foot. Swing right leg over horse's croup and sink softly into saddle—then take right stirrup.
S.D.	Dismounting	Hold reins short. Left hand with reins on horse's withers. Right foot out of stirrups. Right hand on pommel. Stand in left stirrup and transfer right leg over horse's croup and put right hand on cantle. Support weight on both hands. Take left foot out of stirrups. Jump to ground.

The rider's position in the saddle is important as well as his control of the horse. Inasmuch as every horse has not had the same schooling, it is the rider's next accomplishment to adapt his knowledge of position and control to the horse he is riding at the time. If one

combination of Aids does not work, another should be tried. The use of the Aids, therefore, as recommended in this article, is not a hard and fast law. An expert rider will know his horse and use his aids accordingly.

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Activities Engaged in by Teachers of Physical Education in the High Schools of Illinois

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PURPOSE

IT WAS the purpose of this study to find out the existing situation with respect to the activities engaged in by teachers of physical education in the high schools of the state of Illinois. A secondary purpose was to secure information concerning the curriculum in physical education, the training of teachers, and, finally, a self-evaluation of the adequacy of this training.

It was hoped to secure data which might give a description of the duties of teachers of physical education as an aid to the re-evaluation of teacher-training curricula.

PROCEDURE

Three sets of inquiry blanks were used. The first, a white one, was sent to the principal of every high school in Illinois. This contained a letter stating the purpose of the study and asking for cooperation in filling out the blank, and returning it along with those sent to the instructors of physical education.

The second and third sets of blanks were identical, except for color. A yellow one was sent to men teachers of physical education, and a pink one to women teachers. In addition, each was labeled "men" and "women" respectively, as a further aid in handling the data when returned.

These blanks, one for every principal, and one for every full-time or part-time teacher of physical education listed in the Illinois School Directory for 1939-40, were mailed out early in November, 1939. Mimeographed letters were sent to those schools which returned only part of the information requested, or whose responses could not be used because the blanks had been filled out incompletely or incorrectly. Follow-up cards were later sent to those who failed to respond, and a number of personal letters were also written where this seemed desirable. Over a thousand envelopes, containing the inquiry blanks, and a like number of addressed return envelopes, using a postal frank, were mailed. This was later followed by approximately four hundred postal cards and fifty letters.

The data were treated by grouping according to size of school, and the answers to the questions on the inquiry blanks tabulated. It has not been possible, because of lack of time and help, to make many of the cross-comparisons and correlations which must be

completed in order to make full use of the information received. The enrollment groupings were as follows: Group A, up to 50 pupils; Group B, 50-99; Group C, 100-249; Group D, 250-499; Group E, 500-999; Group F, 1000-1999; and Group G, over 2000.

DISCUSSION

Four hundred forty high schools, or 45 per cent of the secondary schools of Illinois, returned inquiry blanks which were usable and are included in this study. Responses ranged from 25 per cent of the small schools (up to 50 pupils) to 70 and 72 per cent of the medium-sized schools (250 to 1000 pupils). Four of the seven enrollment groupings had returns of more than 50 per cent. A school population of more than 150,000 students and 1,000 teachers of physical education is represented by the data in this study. The data must therefore be considered as a representative sampling of the situation in the state of Illinois.

The original report was nearly one hundred pages long, and contained fifty-eight tables and several charts, as well as an Appendix with material in summarized form which did not lend itself to presentation in any other form. In this brief summary, only six tables and one chart will be included.

The first table shows the duties engaged in by the men teachers of physical education, with the responses grouped according to the size of school, and ranked according to total responses for each group. No allowance has been made for duplications, but nearly every instructor had a number of responsibilities. Table II gives similar data for the women teachers of physical education.

Tables I and II indicate the breadth and variety of the duties commonly engaged in by teachers of physical education. As expected, the most frequently listed task of men teachers is that of coaching athletic teams. Every school has at least one coach and a minimum of one varsity team but not every one has a teacher of physical education who may be carrying on a complete program of physical education. Teachers must not only be "paragons of virtue" but highly versatile.

One part of the tables lists the response to questions on testing and measuring. Apparently women teachers of physical education give this part of the curriculum much more emphasis than do the men. More than four hundred individuals, men and women, indicated that they were carrying on some type of testing in their physical education classes. Approximately two hundred filled out the blanks in such a way as to indicate a degree of completeness in this area. In order to secure more information concerning the testing program, and also to secure copies of tests being used, postcards were sent to this group. The response was disappointing. Exactly twenty in-

TABLE I

DUTIES ENGAGED IN BY 538 MEN TEACHERS OF PHYSICAL EDUCATION IN 436 SCHOOLS

School Groupings:	A	B	C	D	E	F	G	Tots.
Number responding	60	90	149	65	30	24	18	436
Per cent of return	25	39	53	70	61	72	36	45
Administration and Supervision								
Coach	34	78	133	60	38	41	71	455
Teacher P. E.	24	61	123	63	37	41	84	433
Director of athletics	19	49	83	45	16	22	22	256
Teacher academic subjects	30	76	19	64	28	11	12	240
Director P. E.	17	33	46	35	23	21	19	194
Director intramurals	4	29	50	39	22	24	22	190
Supervisor P. E.	16	28	44	19	10	9	5	131
Director recreation	8	18	27	19	8	11	6	97
Supervisor of:								
Athletic field	14	43	62	34	17	22	37	329
Gymnasium	18	45	83	42	23	29	20	260
Equipment	18	49	81	39	17	20	14	238
Playground	11	19	31	10	5	13	13	102
Tennis courts	3	11	20	8	6	11	9	68
Pool	0	0	3	9	6	10	34	60
Miscellaneous	0	3	3	10	2	2	21	41
Health Service								
First aid	30	71	103	62	33	41	66	406
Keep team in condition	28	72	116	61	30	29	56	392
Improve community health	18	40	52	40	25	24	50	249
Organize and assist in med. exams	22	39	65	31	23	17	35	232
Prescribe exercises	3	23	38	33	20	24	35	176
Keep follow-up records	13	32	46	27	14	17	23	172
Give other exams	2	2	16	19	7	13	20	79
Miscellaneous	0	1	2	2	1	1	5	12
Promotion of Program								
Promote intramurals	16	52	96	8	36	32	46	286
Athletic publicity	22	37	76	33	16	21	48	253
Officiate games	13	33	65	46	25	30	33	245
Stage exhibitions	5	9	31	30	20	24	34	153
Direct athletic association	8	17	39	19	13	18	20	134
Promote recreation faculty—adults	7	13	34	18	12	13	12	109
Promote health campaigns	6	10	15	10	9	6	24	80
Miscellaneous	0	0	0	1	0	1	1	3
Testing and Measuring in Physical Education								
Achievement tests	1	20	32	35	18	24	42	172
Knowledge tests	2	11	29	43	18	17	28	148
Classification tests	0	7	11	22	11	16	19	86
Motor ability tests	1	8	14	14	7	16	17	77
Strength tests	0	0	9	2	1	7	13	32
Miscellaneous	0	0	0	1	0	1	1	3
Financial Duties								
Purchase equipment—P. E.	23	55	89	45	27	23	32	294
Manage athletic finances	14	32	41	14	8	15	23	147
Make out athletic budget	10	19	26	19	11	17	16	118
Make out P. E. budget	2	10	14	13	14	16	12	81
Miscellaneous Duties								
Church work	20	46	80	35	18	22	14	265
Make speeches	8	14	26	22	20	26	32	148
Miscellaneous	3	19	19	7	7	9	12	75
Direct clubs	4	13	16	17	4	8	12	74

TABLE II

DUTIES ENGAGED IN BY 467 WOMEN TEACHERS PHYSICAL EDUCATION IN 436 SCHOOLS

School Groupings:	A	B	C	D	E	F	G	Tots.
Number responding	60	90	149	65	30	24	18	436
Per cent of return	25	39	53	70	61	72	36	45
Administration and Supervision								
Teacher P. E.	23	61	110	55	33	37	56	375
Teacher academic subjects	23	59	106	43	11	2	43	287
Supervisor gymnasium	5	9	22	21	11	17	10	95
Supervisor equipment	4	8	19	12	9	16	7	75
Director P. E.	1	9	16	11	3	15	14	69
Supervisor athletic field	0	3	10	10	6	9	20	58
Director intramurals	0	1	13	10	9	9	7	49
Supervisor playgrounds	7	4	14	10	5	4	2	46
Supervisor P. E.	2	10	13	9	3	2	1	40
Supervisor pool	0	2	3	6	1	9	18	39
Supervisor tennis courts	1	5	12	9	2	6	0	35
Director athletics	4	5	6	7	3	5	3	33
Coach athletic teams	2	6	5	3	2	9	3	30
Director of recreation	4	3	5	9	2	4	2	29
Miscellaneous	1	2	3	5	0	2	11	24
Health Service								
Render first aid	7	31	53	45	26	34	56	252
Prescribe exercises	1	23	36	29	23	22	37	171
Give orthopedic exams	1	14	24	29	20	28	39	155
Improve community health	10	21	33	20	12	13	44	153
Keep follow-up records	5	11	17	17	11	26	37	124
Organize and assist in medical exams	2	10	18	20	11	16	40	117
Give other exams	1	3	7	9	7	9	27	63
Keep team in condition	1	2	10	8	6	7	8	42
Miscellaneous	0	3	2	4	2	7	4	21
Promotion of Program								
Stage exhibitions	5	17	44	38	29	36	38	207
Promote intramurals	5	15	51	6	32	33	57	199
Direct athletic association	6	14	46	39	24	25	27	181
Officiate	2	10	30	22	15	26	41	146
Promote health campaigns	3	4	9	15	8	11	35	85
Carry on publicity	1	5	10	7	8	9	17	57
Promote recreation	1	6	8	12	6	5	13	51
Miscellaneous	3	2	2	3	2	3	3	18
Testing and Measuring								
Achievement tests	5	17	48	40	24	32	48	214
Knowledge tests	2	17	34	35	21	34	30	173
Motor ability tests	1	3	12	19	13	12	40	100
Classification tests	1	4	8	9	8	14	22	66
Strength tests	0	1	1	1	1	2	6	12
Miscellaneous	0	0	1	0	1	5	2	9
Financial Duties								
Purchase equipment and supplies	2	9	25	18	6	17	23	110
Manage finances	1	4	8	6	5	5	15	44
Make out budget, interscholastic	0	2	5	7	8	9	8	39
Miscellaneous	1	2	1	0	3	2	6	15
Make out budget P. E. only	0	0	1	0	0	0	1	2
Miscellaneous Duties								
Church work	14	36	62	24	6	8	7	157
Speeches	2	7	14	10	4	5	4	46
Direct Clubs	3	8	8	7	7	4	3	40

dividuals responded, and of this group, all but four or five were women. Undoubtedly, many did not choose to send copies of tests which they had devised for their own use. It is also likely that some

TABLE III

ACTIVITIES INCLUDED IN THE CURRICULUM FOR BOYS

Groups	A	B	C	D	E	F	G	Tots.
Basketball	33	79	135	65	41	42	80	475
Softball	32	51	135	58	34	40	63	413
Volleyball	19	64	116	62	32	38	68	399
Calisthenics	17	60	100	53	24	38	79	371
Baseball	20	61	118	38	28	26	69	360
Touch football	18	52	89	54	32	32	60	337
Relay races	11	43	97	46	30	40	62	329
Track and field	19	53	105	51	28	41	30	327
Floor-mat stunts	6	39	86	57	27	38	64	307
Group games	13	45	74	45	32	32	54	295
Tumbling	5	32	70	52	29	41	61	290
Individual athletics	6	27	61	33	26	25	49	227
Marching	15	27	34	30	18	28	65	217
Soccer	9	25	68	34	18	16	40	210
Combative contests	5	26	59	34	18	24	42	208
Boxing	4	34	67	41	21	13	24	204
Table tennis	16	31	58	34	20	20	19	198
Wrestling	4	27	49	42	20	24	32	198
Stunts	1	15	41	40	21	25	49	192
Horseshoes	13	28	61	27	18	14	4	165
Pyramids	1	27	45	30	21	24	16	164
Badminton	5	21	39	35	19	21	22	162
Tennis	11	16	40	32	17	19	23	158
Apparatus	1	4	15	22	17	25	49	133
Adapted sports	4	14	30	13	14	17	32	124
Shuffleboard	2	24	25	25	17	11	5	109
Handball	6	12	28	37	6	8	11	108
Paddle tennis	5	20	41	24	10	10	4	104
Lifesaving	2	5	12	14	9	14	37	93
Social dancing	3	9	18	15	8	10	28	91
Swimming	0	3	5	12	10	19	42	91
Golf	1	1	12	17	8	11	25	75
Deck tennis	1	9	15	22	9	9	6	61
Folk dancing	0	8	25	9	10	2	4	58
Archery	2	5	18	11	7	6	2	51
Darts	2	11	9	8	8	6	5	49
Quoits	3	7	7	7	3	6	6	39
Exercises with hand apparatus	1	0	8	7	4	5	13	38
Winter sports	1	12	6	4	6	1	6	36
Box hockey	0	7	7	6	4	6	0	30
Sidewalk tennis	0	5	5	8	5	2	1	26
Tap or clog	0	3	5	5	5	2	3	23
Tetherball	2	2	2	7	3	4	0	20
Miscellaneous	0	4	4	7	3	2	0	20
Ice skating	0	5	3	4	1	1	4	18
Modern dance	0	3	4	1	3	1	4	16
Fencing	0	0	1	0	2	1	11	15
Croquet	0	2	5	4	2	1	0	14
Bowling	0	1	3	2	2	1	2	11
Field hockey	0	2	4	1	2	2	0	11
Roller skating	1	3	2	3	1	0	1	11
Squash racquets	0	2	1	1	2	0	0	6

did not have nearly as complete a testing program as the original answers seemed to indicate.

Tables III and IV indicate the activities included in the curriculum. Again, totals are given for each activity and for each group, with the various activities ranked in order of frequency of mention.

TABLE IV

ACTIVITIES INCLUDED IN THE CURRICULUM FOR GIRLS

Groups	A	B	C	D	E	F	G	Tots.
Volleyball	20	67	117	62	34	38	62	400
Basketball	23	67	115	62	31	34	57	389
Group games	21	61	107	57	33	36	61	376
Calisthenics	17	47	100	51	27	31	60	333
Relay races	14	48	86	55	28	35	58	324
Softball	18	58	100	42	21	25	55	319
Folk dancing	12	41	77	47	29	28	64	288
Floor and mat stunts	9	39	70	52	30	32	50	282
Marching	11	38	79	40	26	26	55	275
Baseball	17	39	75	37	25	28	49	270
Stunts	6	29	73	33	28	24	49	242
Table tennis	4	29	52	32	24	22	51	214
Tumbling	7	19	53	48	26	22	37	212
Social dancing	6	28	45	37	21	26	39	202
Soccer	5	14	52	39	21	21	49	201
Tennis	3	20	44	35	21	23	35	181
Badminton	4	8	32	38	22	26	46	176
Pyramids	7	21	49	37	22	21	15	172
Shuffleboard	3	20	28	27	18	21	52	169
Deck tennis	6	10	39	36	14	21	26	152
Tap or clog	2	9	32	28	14	16	39	140
Modern rhythmic dancing	1	16	23	22	13	21	29	125
Adapted gymnastics	0	20	25	18	7	18	27	115
Track and field	3	8	21	15	12	7	45	111
Individual athletics	1	5	16	15	14	26	26	103
Archery	3	9	19	29	14	19	7	100
Swimming	2	1	4	7	7	20	53	94
Horseshoes	2	11	18	11	14	6	23	85
Paddle tennis	4	9	21	13	7	16	14	84
Apparatus stunts	0	1	12	10	9	8	38	78
Dart throwing	1	5	15	16	7	13	21	78
Field hockey	0	1	8	12	9	22	16	68
Lifesaving	0	3	7	7	4	11	24	57
Handball	3	8	22	15	3	1	4	56
Golf	0	1	6	9	2	8	28	54
Aerial darts	0	4	8	14	8	11	8	53
Quoits	0	6	3	12	7	5	19	52
Bowling	1	2	5	7	3	7	24	49
Exercises with hand apparatus	1	2	9	10	4	5	10	41
Touch football	1	5	9	7	2	4	4	32
Sidewalk tennis	1	3	5	5	1	3	9	27
Box hockey	0	2	5	9	3	3	5	27
Miscellaneous	1	3	7	4	4	4	3	26
Combative contests	1	2	8	6	3	1	3	24
Winter sports	1	2	6	4	2	2	6	23
Roller skating	2	2	5	4	0	2	6	21
Croquet	2	3	4	6	1	4	0	20
Tetherball	0	1	3	3	2	3	2	14
Ice skating	2	1	3	3	1	0	4	14
Fencing	0	0	0	0	0	2	7	9
Squash racquets	2	0	0	0	1	0	0	3

Basketball is "King of All Sports," not only in varsity athletics but also in the curriculum in physical education. This activity lends itself readily to inclusion in the class program, since it requires little equipment and meets with tremendous social approval. Furthermore, almost all physical education curricula center around a gymnasium, constructed primarily for the game of basketball.

The completeness of the curriculum indicated by the data in the two tables would be most encouraging, were it not for the fact that in the great majority of responses, less than a third or a fourth of the activities listed in the blank were checked by individual instructors. The activities most frequently checked center almost entirely around team and "varsity" sports for boys, although considerable emphasis is also given to group or mass activities requiring little or no special equipment. The pressure of coaching varsity athletics with resulting interest in developing material for school teams, as well as limited facilities and equipment, may be contributing factors.

Activities such as individual sports, the dance, and a large variety of recreational activities predominate in the list for girls. Many excellent activities such as swimming, ice skating, bowling, golf, and tennis are listed relatively few times by both groups of instructors, and then almost entirely by those in the large schools. Undoubtedly facilities and equipment again are limiting factors, although sometimes the lack of interest or even the inertia of the teachers of physical education may be the real reason. Relatively few activities have spectator appeal, and it may be easier to concentrate on those.

Tables V and VI show the varsity sports coached by instructors of physical education, again given in rank order. The table showing sports coached by women apparently indicates that there is "varsity"

TABLE V

VARSITY SPORTS COACHED BY MEN TEACHERS OF PHYSICAL EDUCATION

Groups	A	B	C	D	E	F	G	Tots.
Basketball	33	77	129	55	26	29	30	369
Track and field	18	39	100	41	18	22	9	237
Football	0	10	59	51	25	31	29	205
Baseball	14	48	73	10	11	5	10	171
Softball	23	30	42	13	5	3	2	118
Tennis	1	5	12	6	1	11	15	51
Golf	0	0	4	5	9	11	12	41
Wrestling	1	1	7	7	6	6	8	37
Swimming	0	0	1	3	2	10	18	34
Miscellaneous	0	2	1	5	5	1	8	22
Cross country	0	0	3	5	3	5	5	21
Table tennis	3	1	8	4	2	0	2	20
Boxing	0	0	2	3	12	0	1	18
Touch football	1	1	16	1	3	3	4	19
Soccer	1	2	2	2	1	0	4	12
Horseshoes	1	3	1	3	1	1	1	11
Folk dance	0	0	2	1	0	0	1	4
Ice hockey	0	0	0	0	0	1	0	1
Lacrosse	0	0	0	0	0	0	1	1

TABLE VI

SPORTS COACHED BY WOMEN TEACHERS OF PHYSICAL EDUCATION

Groups	A	B	C	D	E	F	G	Tots.
Basketball	4	11	17	7	3	6	4	52
Baseball	2	6	6	1	2	2	9	28
Softball	2	5	9	4	2	3	3	28
Track-field	0	1	7	4	2	1	12	27
Tennis	2	3	3	2	3	6	1	20
Miscellaneous	0	4	6	1	4	1	2	18
Swimming	1	1	1	0	2	5	6	16
Table tennis	1	2	3	2	1	1	3	13
Field Hockey	0	0	2	2	0	3	2	9
Soccer	0	0	3	0	1	1	4	9
Folk dancing	1	1	4	1	1	0	0	8
Golf	0	0	0	1	0	3	2	6
Horseshoes	0	0	1	0	1	0	1	3
Ice hockey	0	0	0	1	0	0	0	1
Lacrosse	0	0	0	0	0	1	0	1

competition between picked teams of girls from different schools, but such is not the case. The Illinois High School Association expressly forbids interscholastic competition for girls, although some competition between groups as well as schools is provided through the G.A.A. program, organized playdays, and in many cases, extensive intramural offerings.

Basketball reigns supreme, but it is possible that the rapid increase in popularity of six-man football may eventually change the ranking for boys, particularly among the small and medium-sized schools. Certain items may possibly have been checked erroneously, as for instance, the listing of folk dancing as a varsity or interscholastic sport for boys, and ice hockey and lacrosse for girls.

Chart I shows graphically a comparison between the activities included in the curriculum for boys as pictured by the data secured in this study, and a somewhat similar survey carried on by Monroe, in 1926.[1] In studying the chart, certain facts must be kept in mind. Monroe's study was national in scope. It included 1032 men teachers of physical education in high schools located in 725 cities, representing every state except Wyoming. The present study was concerned only with the situation in Illinois, and the chart presents data contributed by 538 men teachers of physical education in approximately five hundred schools. Furthermore, the information secured in this study includes many activities either invented or popularized since 1926, and now occasionally introduced into the curriculum of physical education. A similar comparison for the activities taught by women teachers of physical education is omitted since no other study similar to Monroe's could be found.

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1 W. S. Monroe, "The Duties of Men Engaged as Physical Directors or Athletic Coaches in High Schools," *University of Illinois Bulletin*, 38 (1926) p. 10.

CHART I

COMPARISON OF POPULARITY OF ACTIVITIES IN PHYSICAL EDUCATION CURRICULUM FOR BOYS BETWEEN PRESENT STUDY AND MONROE'S STUDY

Present Study				Monroe's Study			
	(As reported by 538 men instructors in Illinois)	Times Mentioned	Per Cent of Total		(As reported by 1032 men instructors in the United States)	Times Mentioned	Per Cent of Total
1.	Basketball	475	88				
2.	Softball	413	77				
3.	Volleyball	399	74				
4.	Calisthenics	371	69	1.	Calisthenics	721	70
5.	Baseball	360	66				
6.	Touch football	337	63				
7.	Relay races	329	61	2.	Basketball	623	60
8.	Track and field	327	61	3.	Group games	614	60
9.	*Floor-mat stunts*	307	57	4.	Relay races	599	58
10.	Group games	295	55	5.	Marching	578	56
11.	Tumbling	290	54	6.	Track and field	567	55
				7.	Volleyball	548	53
				8.	Individual athletics	499	48
				9.	Apparatus stunts	452	44
12.	Individual athletics	227	43	10.	Baseball	444	43
				11.	Tumbling	431	42
13.	Marching	217	40	12.	Football	415	40
14.	Soccer	210	39	13.	Correctives	397	39
15.	Combative contests	208	39				
16.	Boxing	204	38				
17.	*Table Tennis*	198	37	14.	Playground ball	382	37
18.	Wrestling	198	37	15.	Exercises with hand apparatus	357	35
19.	*Stunts*	192	36	16.	Combative contests	352	34
20.	*Horseshoes*	165	31				
21.	Pyramids	164	30				
22.	*Badminton*	162	30				
23.	Tennis	158	29	17.	Pyramids	291	28
24.	Apparatus stunts	133	25	18.	Soccer	253	25
25.	Adapted sports	124	23				
26.	*Shuffleboard*	109	20				
27.	Handball	108	20				
28.	*Paddle tennis*	104	19	19.	Wrestling	178	17
29.	Lifesaving	93	17	20.	Tennis	174	17
30.	*Social dancing*	91	17	21.	Boxing	167	16
31.	Swimming	91	17	22.	Gymnastic dancing	161	16
32.	Golf	75	14	23.	Swimming	143	14
33.	*Deck tennis*	61	11	24.	Lifesaving	119	12
34.	Folk dancing	58	11	25.	Handball	110	11
35.	*Archery*	51	9				
36.	*Darts*	49	9				
37.	*Quoits*	39	7	26.	Folk dancing	74	7
38.	Exercises with hand apparatus	38	7	27.	Winter sports	68	7
39.	Winter sports	36	7				
40.	*Box hockey*	30	6				
41.	*Sidewalk tennis*	26	5				
42.	*Tap or clog*	23	5				
43.	*Tetherball*	20	4	28.	Golf	37	4
44.	Miscellaneous	20	4				
45.	Ice skating	18	3	49.	*Bowling*	11	2
46.	*Modern dancing*	16	3	50.	*Field hockey*	11	2
47.	*Fencing*	15	3	51.	*Roller skating*	11	2
48.	*Croquet*	14	3	52.	Squash rackets	6	1

The items listed in italic type are new ones, not included in Monroe's survey. A comparison of the percentages will show the increase or decrease in popularity of the various activities.

Significant facts are the increase in popularity of certain sports, primarily basketball and softball, and the decrease in emphasis on such activities as apparatus stunts, correctives, and particularly exercises with hand apparatus. In view of the emphasis on sports, as well as a decrease in the number of instructors qualified to teach certain "formal" activities, this might be expected. The difference in cost of equipment is probably an even greater factor. Apparatus as well as most equipment for individual or dual sports is very expensive, but a class may participate in a team sport, such as basketball or softball, with relatively little expense.

CONCLUDING STATEMENT

The data secured in this study were helpful in presenting a picture of the existing situation with respect to physical education in the secondary schools of Illinois. Some assistance was given to a committee which was studying the curricular offerings for a major and minor in physical education in the College of Education. The re-evaluation of the curriculum in the School of Physical Education was also more comprehensive as a result of the trends indicated by the study.

Most of the information secured in the study has not been presented. Information on the organization and administration of the program, and facilities, as furnished by the principals has been omitted. Likewise, data on the training of teachers, teaching load, weekly schedule, summer occupation, professional interests, and self-evaluation of training as presented by the instructors of physical education is not included. The data were most revealing in indicating gaps and weaknesses, both in the curriculum in physical education, and in teacher-training curricula. It is hoped to show these trends in some future article.

Acknowledgements—This study was financed by the College of Education and the School of Physical Education. A committee of six, including Dr. E. F. Potthoff and Dr. C. W. Sanford of the College of Education, and Miss Louise Freer, Miss Florence Lawson, Dr. S. C. Staley, and the writer, from the School of Physical Education, developed the inquiry blanks and helped determine the direction of the survey.

Special credit must be given to J. E. Lotzer, University of Illinois student and N.Y.A. assistant, who sent out the inquiry blanks, and through painstaking and conscientious work, completed the initial tabulation of the data.

The Graduate Major In Physical Education

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THE schools of education offer 85 per cent of all doctor's degrees and 51 per cent of all master's degrees available for the graduate major in physical education. There are 56 institutions in the United States offering a graduate major in physical education for an advanced degree. Such is the picture derived from a comprehensive survey made of all United States institutions offering the graduate major in physical education for the master's or doctor's degrees.

The results of this study bring to mind four pertinent questions:

1. Is the physical education major at the graduate level becoming more closely associated with the school of education because it is an integral part of education and rightly belongs there?

2. Is physical education at the graduate level such a new and growing profession that it lacks the respect of an old, established profession and is unable to stand on its own merits and confer its own degrees and so must combine itself under the School of Education?

3. Will the prevailing conditions now existing be detrimental by hindering the future growth of the physical education profession from becoming an upstanding body comparable to other established professions, notably those of law, engineering, or medicine?

4. Will our present war emergency have much effect on graduate work in the future?

Perhaps time itself will provide answers to the above questions.

THE SURVEY

Fifty-six schools in the United States offer the graduate major in physical education and in these institutions twenty-one offer one or more types of doctor's degrees and fifty-six confer one or more types of master's degrees. (See Table I).

The number of schools in the United States offering the graduate major in physical education for the master's or doctor's degree has increased more than twofold during the past five years. Twenty states do not have any institution offering the graduate major. Norris and Sweet[1]* in a survey made in 1937 found that there were thirty institutions offering graduate work in physical education. H. Harrison Clark[2] in another survey in 1934, found thirty-one institutions, and

* Superior figures refer to numbered Bibliography at end of article.

of this number, twenty-six offered the physical education major leading to the master's degree.[2, 5] Both of the latter surveys included institutions offering only a few courses at the graduate level and many of these institutions did not confer degrees in the physical education field of specialization. This survey was limited to major schools only and did not include those institutions offering a few graduate courses or even the graduate minor in physical education.

TABLE I

INSTITUTIONS OFFERING GRADUATE DEGREES IN PHYSICAL EDUCATION

Institutions by States	Higher Degrees Offered	
	Master's	Doctor's
Alabama		
University of Alabama	M.A. in Educ.	
California		
Claremont College	M.A.	*
College of the Pacific	M.A.	
Mills College†	M.A.	
	M.Ed.	
Stanford University	M.A.	Ed.D.
	M.A. in Educ.	Ph.D. in Educ.
		Ph.D.
University of California, Berkeley	M.A.	
University of California, Los Angeles	M.A.	
University of Southern California	A.M.	Ed.D.‡
	M.S.Ed.	
	M.Ed.	
Colorado		
Colorado State College of Education	M.A.	
University of Colorado	M.S.§	
Idaho		
University of Idaho	M.S. (Ed.)	
Illinois		
George Williams College	M.S.	
Northwestern University	M.A. in Educ.	
Indiana		
Indiana University	M.S. in Educ.	Ed.D.
		Ph.D. in Educ.
Purdue University ||	M.P.E.	
Iowa		
The State University of Iowa	M.A.	Ph.D.
Kansas		
The University of Kansas	M.S. in Educ.‡	
Kentucky		
University of Kentucky	M.A.	Ph.D. in Educ.
	M.A.Ed.	
	M.S.Ed.	
Louisiana		
Louisiana State University	M.S.	Ph.D. in Educ.

* Claremont College could offer the Ph. D. but as yet no candidates. No requirements set up.
† Women only.
‡ Combined physical education major.
§ Offers degree work in summer session only.
|| Men only.

TABLE I—Continued

Massachusetts		
Boston University	Ed.M.	Certificate of Advanced Specialization*
	Ed. M (cum laude)	
	M.A. in Educ.	Ed.D.
Smith College	M.Ed.	
Springfield College	M.P.E.	
	M.Ed.	
Wellesley College†	M.S.	
Michigan		
University of Michigan	M.A. in Educ.	Ed.D.
	M.S. in Educ.	Ph.D. in Educ.
Wayne University	M.Ed.	
Minnesota		
University of Minnesota	M.Ed.	
Missouri		
University of Missouri	M.A. in Educ.	Ed.D.
	M.Ed.	Ph.D. in Educ.
Montana		
The State University of Montana	M.A.	
New Mexico		
University of New Mexico	M.A. in Educ.§	
	M.S. in Educ.§	
New York		
Columbia University	A.M. in Educ.	Ed.D.
	M.S. in Educ.	Ph.D. in Educ.
New York University	M.A in Educ.	Ed.D.
		Ph.D. in Educ.
Syracuse University	M.S. in Educ.¶	Ed.D.
		Ph.D. in Educ.
North Carolina		
University of North Carolina	M.A.	
	M.A. in Educ.	
	M.Ed.	
Ohio		
Cincinnati University	M.Ed.	Ed.D.
Kent State University	M.A.	
Oberlin College	M.A.	
Ohio State University	M.A.	Ph.D.
Ohio University	M.A.	
	M.S. in Ed	
	M.Ed.	
Oklahoma		
Oklahoma A. and M. College	M.S.	
Oregon		
University of Oregon	M.A.	Ed.D.‡
	M.S.	Ph.D. in Educ.‡
Pennsylvania		
Pennsylvania State College	M.S.	Ed.D.
	M.Ed.	Ph.D.
University of Pittsburgh	M.A.	Ed.D.
	M.Ed.	Ph.D. in Educ.
Temple University	M.Ed.	
University of Pennsylvania	M.S. in Educ.	**

* Boston University offers a certificate of advanced specialization, half way point between master's and doctor's degrees.

¶ Syracuse University also offers a degree of Master of Public Administration in Recreation.

** University of Pennsylvania planning doctor's degree.

Tennessee		
George Peabody College for Teachers	M.A. in Educ. M.Ed.	Ph.D. in Educ.
Texas		
Baylor University	A.M.	
North Texas State Teachers College	M.A. M.S.	
Texas State College for Women	M.A.	
University of Texas	M.Ed.	Ed.D. Ph.D. in Educ.
Utah		
Brigham Young University	M.A. M.S.	
University of Utah	M.A. in Educ. M.S. in Educ.	
Washington		
State College of Washington	M.S.	
University of Washington	M.S. M.A.	
West Virginia		
University of West Virginia	M.S.	
Wisconsin		
University of Wisconsin	M.S.††	
Wyoming		
University of Wyoming	M.A. in Educ. M.S. in Educ.	Ed.D. Ph.D. in Educ.

†† University of Wisconsin offers M. S. for men and women; for men only the M. S. Degree combined major in physical education and education.

(Note: if any institution has been omitted, or if any of the above information is incorrect, the author will greatly appreciate notification of such omissions or errors.)

To show the growth of graduate work during the past five years, it is interesting to compare the number of graduate degrees available by major schools of physical education as shown by the Norris and Sweet survey of 1937 with that of the author's survey of 1942 (see Table II).

TABLE II

NUMBER OF ADVANCED DEGREES AVAILABLE WITH A GRADUATE MAJOR IN PHYSICAL EDUCATION

Norris and Sweet Survey (1937) 30 Schools Offer Graduate Work in Physical Education		Hewitt Survey (1942) 56 Institutions Offer Major Work in Physical Education	
Master's Degrees (all types)	28	Master's Degrees (all types)	82
Doctor of Education	8	Doctor of Education	15
Doctor of Philosophy	11	Doctor of Philosophy	19
Total	47	Total	116

In an analysis of the different types of degrees available for the graduate major in physical education at the master's or doctor's level, the school of education confers 51 per cent of the master's degrees and 85 per cent of the doctorates. The Master of Arts was offered in 22 institutions and next in order was the Master of Education, given in 16 schools. Only two institutions gave professional degrees in physical Education (see Table III).

TABLE III

TYPES AND FREQUENCIES OF ADVANCED DEGREES AVAILABLE IN PHYSICAL EDUCATION IN 56 INSTITUTIONS OF THE UNITED STATES

Master's Degrees		Doctor's Degrees	
Master of Arts	22	Doctor of Education	13
Master of Education	16	Doctor of Philosophy in Education	13
Master of Arts in Education	14	Doctor of Philosophy	5
Master of Science	13	Combined Major in P.E. and Ed. Doctor of Education	2
Master of Science in Education	12	Doctor of Philosophy in Education	1
Master of Physical Education	2		
Master of Public Administration in Recreation	1		
Combined Major in P.E. and Education—M.S.	2		
Total	82	Total	34

SOURCES OF INFORMATION

In order to determine all the institutions in the United States and to secure other pertinent information the following source material was used.

1. Catalogs were analyzed from every institution offering a graduate major in physical education.

2. Questionnaire analysis from catalogs was sent to each of the graduate schools offering the major for verification, additions, or correction of errors.

3. Letters of inquiry concerning a check on graduate schools were sent to all state directors[3] of physical education. In states having no state director, a letter of inquiry was sent to the head of the physical education department in the state university of the state named.

4. Personal visits were made to eleven western institutions in Idaho, Washington, Oregon, and California. Three eastern institutions were consulted through representatives of the institutions.

5. Postcards were sent to all registrars in United States institutions offering an undergraduate major in physical education to ascertain if a graduate major were offered.

REFERENCES

1. Norris, J. A., and D. C. Sweet, "A Survey to Determine the Status of Graduate Work in Physical Education," *Res. Quart.*, 8:4 (Dec. 1937) 3-10.
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3. "State Director's List," American Association for Health, Physical Education and Recreation. Compiled by the Physical Education Service of the National Recreation Association.
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5. Clarke, H. H., "A Survey of the Requirements for the Master's Degree in Physical Education" (from Jay B. Nash, *Professional Preparation* [New York: A. S. Barnes and Co., 1935] 329-361).